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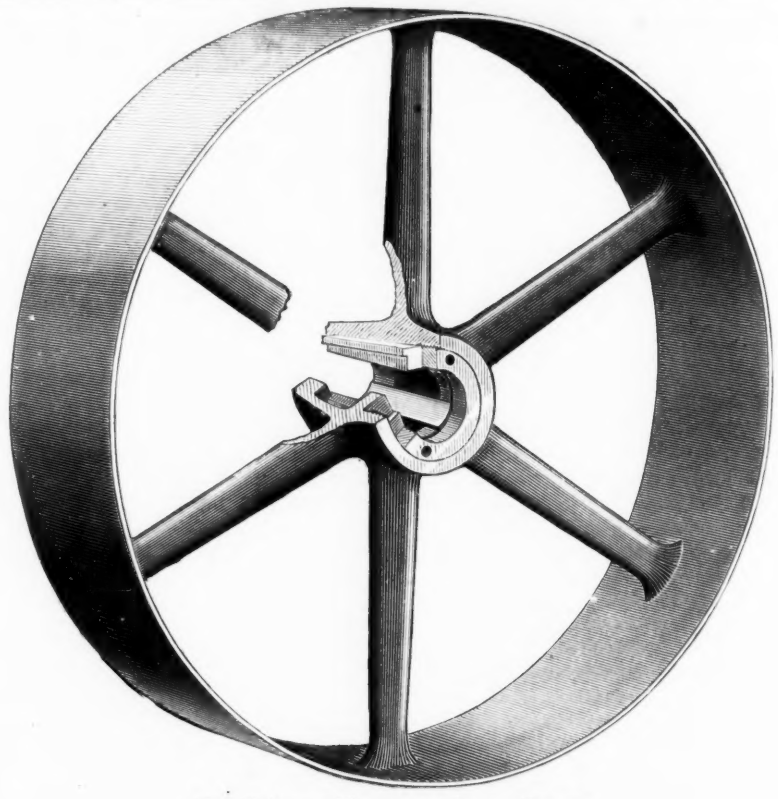
The Blevney Universal Chuck Pulley.

The engraving represents a new pulley brought out by the Blevney Manufacturing Company, Newark, N. J. In this pulley the bearing on the shaft is by means of three jaws or wedges resting in suitable seats or ways in the hub, and so constructed that they cannot fall out of place when the pulley is off the shaft. These jaws are first made, and in casting the pulley are placed in the mould where they serve the end of chills around which the iron forms their seats in the hub. The iron holds the jaws in place sufficiently firm to permit of their being bored to size, but leaves them free to be moved longitudinally. When the pulley is in the machine for boring, the outer end of the hub is internally threaded for the screw collar shown in the engraving. When the pulley is to be made fast to the shaft the collar is screwed in, and abutting against the ends of the jaws or wedges carries them along, while by their taper they approach the shaft, securely locking the pulley. For loosening the pulley it is only necessary to loose the collar and start one of the jaws back by a slight blow on its outer end.

From the foregoing it will be understood that the gripping jaws are moved inwardly at a uniform rate, so no matter what distance they may be moved, when they come in contact with the shaft the rim of the pulley will be held concentric with the shaft, and hence will run true and in balance. This it is claimed permits the use of these pulleys on shafts varying as much as one-sixteenth of an inch either way from standard size, without any of the difficulties incident to fastening an ordinary constructed pulley on a shaft smaller than the bore of pulley, or trying to use such a pulley on a shaft slightly larger than its bore. It also permits it to be readily placed on some part of a shaft smaller than the rest, where it must be passed over the larger portion, and provides for its running true when in place.

It will be seen from the engraving that while the hub of the pulley is strengthened by annular internal flanges or ribs, the section at all parts is practically the same as the section of arms. This is possible because no extra thickness is required for set screws, and its accomplishment avoids the strains in casting incident to a heavy hub, and permits making the pulley lighter than would otherwise be possible. It is claimed that this pulley can be made quite as cheaply as the ordinary set screw pulley; also that the principle is particularly advantageous in making split pulleys, admitting, as in whole pulleys, of easy fitting up and correct distribution of metal.

Last week a superlative idiot in Posey County, Indiana, wanted to be funny, and the idea passed through his adamantine skull that it would be a good joke to raise the report that the steamer Rosa Belle had exploded her boiler, killing the captain and engineer. This heartless lie was telegraphed widecast and caused boundless distress to the relatives of the supposed victims. The law's penalties are impotent in punishing a crime of this kind. There is a good deal to be said in favor of a proposal made by the *Marine Journal* to tar and feather the miscreant who resorted to that malicious form of self-enjoyment.



THE BLEVNEY UNIVERSAL CHUCK PULLEY.

Sedgwick Portable Steam Engine.

The semi-portable boiler and engine, illustrated herewith, is the latest production of the Sedgwick Manufacturing Company, of Poughkeepsie, N. Y.

The machine is the outgrowth of an intention to produce an article that would give all the necessary requirements as to good service, at reasonable cost.

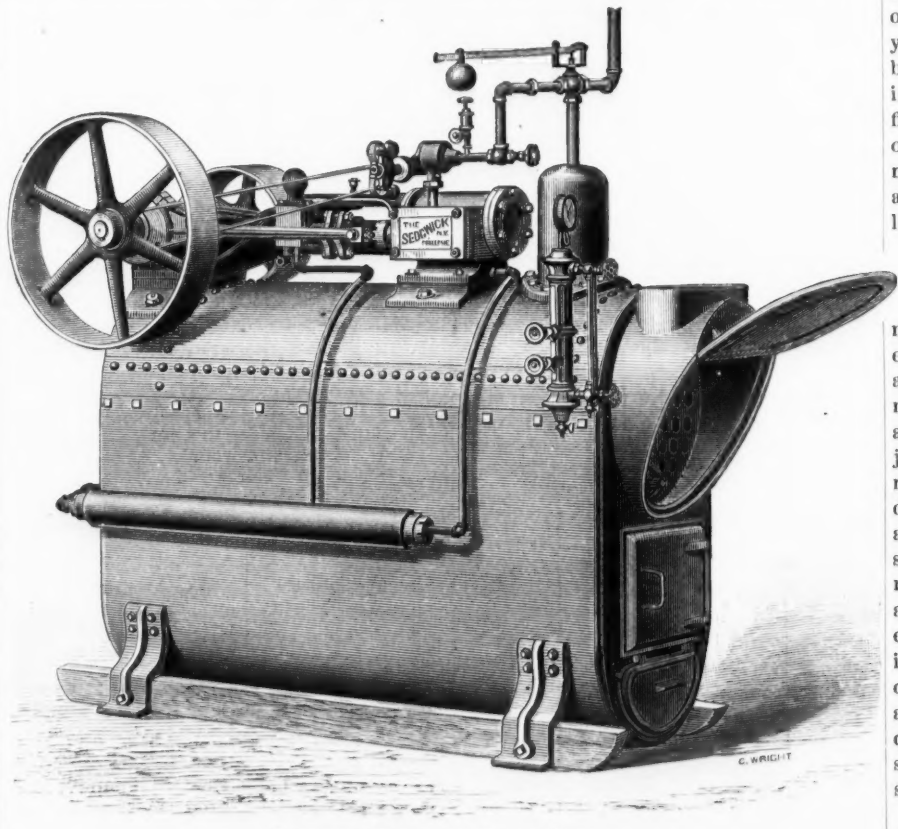
The boiler is put together in a workmanlike manner, and is complete in all details. The engine is of the center-crank type, and is mounted even on top of boiler, ample provision being made for contraction and expansion.

The design of frame is declared by the builders to be entirely original, and is such as to combine both strength and elegance. There being an equal distribution of metal a sound casting can easily be made. The working parts, all of which are of steel, are held in one piece, and by improvements in construction it is claimed to be impossible to get the parts out of line. The frame is also of such shape as to catch all drip and to convey it clear of the boiler. Power is communicated both from balance wheel and driving pulley, and the engine can be therefore belted at different speeds, direct. It is provided with pump and heater, arranged so as to best subserve their purpose. An injector can be substituted at the option of the user.

The engine is governed by the Wright governor, and has low set steam chest and the ordinary slide valve, with the best adjustment as to steam economy and easy running.

No assumption of a fine finished engine is made; the cost of superfluous finish being avoided. No unnecessary labor has been put on The aim has been only to make perfect and lasting the working parts; thus enabling a minimum to be reached in regard to cost and labor, with all the weight necessary.

The engines are made in sizes varying from 2 to 12 horse-power, and can be placed on separate foundations, or on boiler at option of user.



SEDGWICK PORTABLE STEAM ENGINE.

Store System of the Atlantic Works of Manchester, England.

BY GEORGE RICHARDS.

In a former letter I mentioned some plans of a new works, also a system of keeping stores as a means of cheapening the cost of producing machines. The new works referred to are now completed, and regarded as satisfactory, especially in one point, and that the most important, viz.:—a capacity for the largest out-put with a certain amount of dead capital in buildings and plant. I trust your readers will have an opportunity of judging of these works by drawings in your columns at some future time. I have noticed that there is more uniformity in the design of engineering works in England than with you, owing, no doubt, to more attention being paid to detail, and the element of cost in carrying on. Capital is cheaper, and the first cost of buildings and plant is considered only as to the best disposition for the investment to suffer the least by wear and tear, and depreciation. Plans are made here looking to many years in the future—both as to depreciation and probable extension in the departments. In America there is no doubt more enthusiasm displayed in a great many cases, and the object in view seems to extend to a few years—that is, to get started as quickly as possible, so as to commence making money while a boom lasts. Works are run up in a great hurry, and I should judge very little attention is paid to the reasons for what others have done. No doubt in the future some genius will go ahead of his time, and prove that a certain size, form, and plan of works is suitable for making steam engines to a stated capacity, and another works for machine tool making, etc. So far as I can observe, the chief fault is the tendency in building new works to incorporate as much as possible of familiar arrangements in old work shops with corners, angles, shafting, etc., whereas these should be left out of the plans unless possessing some advantages.

It has lately occurred to me that if a good firm of architects were to study machine

manufacturing, so as to be competent judges of *how* to erect economical works, they would find plenty of clients. Cotton mills for example where capital is based against results, are now constructed like ocean steamers on plans as to the best economy, and attention has to be paid to the smallest detail of arrangement. In fact, I was told the other day of a large cotton mill that could not pay because the spinning room, although three hundred feet long, was eight feet too narrow to admit of the number of spindles in its width, that the results of careful records showed produced the most economic results.

It is not intended to argue that works for machine tool, or engine building should be critised from this standpoint, but to call attention to the endless variety of shops in all parts of America that differ in almost every detail of construction. This matter will be dealt with in a future letter, when describing the works just completed here, and the arguments *pro* and *con* are discussed.

Your readers, however much convinced by arguments on the construction of workshops, can not commence deriving advantage from them by building new works, but this excuse does not hold good for what I propose to describe as the *stores system* of workshop procedure. By "stores" I do not mean such articles as are generally stored for general use, such as waste, oil, tallow, files, belting, etc., but *all* articles coming into the works as material to be used in the construction of the finished product. Therefore the stores room should occupy as much space as can be afforded for it—using an exaggerated form of expression, it cannot be too large. It should be near the general entrance for goods, and accessible from the various departments of the works as well as the office. The system of shelves, cupboards, and internal arrangements should differ for various articles stored and according to the branch of products made.

After the equipment of the stores room, the next thing is a man to take charge of it—one with a knowledge of entry-keeping and checking invoices. He should also possess a knowledge of the parts used in the machines made, so as to recognize each piece and know its final destination in the works.

As assistants, a lad or two will be found useful in many ways. These are always at hand, and it is an admirable plan to have all lads pass *through* the stores room, to acquaint them with the run of the works, the rules, and to make them feel at home before launching out in the works to be buffeted about by the workmen.

During the time the lads are in the store room—say for a month or so—an opportunity is afforded for judging of their character for working and truthfulness.

The various duties likely to devolve upon the storekeeper are the following: The orders for all the goods purchased should pass through him, by his writing the orders, but having them signed in the office by the manager or proprietor. Orders are principally for coal, iron, castings, screws, oil, waste, patternmakers' requirements, etc.

All goods supplied from outside should be accompanied by a delivery note; in fact, a rule should be made not to accept or sign for them without. These delivery notes are checked by the storekeeper, and a symbol placed on them indicating to what department they are to be charged. They are also kept for checking the invoices which generally follow some days after the delivery of the goods.

In regard to ordering any article wanted, such as oil, coal, timber, these are often asked for only when they are wanted in many works, as there is no one source to apply for them; but with a storekeeper this is part of his duty, and any failure can be reprimanded as required. A shop manager of long experience, with whom I was once connected, always impressed upon his staff that *nothing should be ordered when it was urgently wanted*—meaning, of course, that it should have been on hand when *wanted*.

The storekeeper is also expected to keep posted upon the market value of all articles used, and for this purpose a printed inquiry for a quotation of price and delivery is used to send out to various supply dealers. He also should report upon the quality and defects of his purchases, so the defects may be rectified before they are used.

Many other duties could be explained, but to those engaged in conducting a works their experience will dictate what is wanted. In works where a small number of men are employed, the small tools, taps, reamers, and gauges can also be kept in the stores room, so that no extra staff is required for checking them as they are given out and returned.

Having now explained the store-keeper's duties as a purchasing agent, the plan of collecting the parts required for machines in progress of construction will be described. This was really the purpose of this article, but a few preliminary remarks have been made to lead up to it.

Annexed will be found the forms of four sheets, especially prepared to simplify the work—one each for "Castings," "Forgings," "Screws" and "Bolts," and "Miscellaneous parts." The sheets are foolscap size.

Every order for work passing through the shops has a set of these written out, and when done with they are returned to the cost-keeping clerk.

It will be necessary to go back a little and mention the drawings and patterns, as this is an integral part of the system.

Symbols and numbers have often been discussed in your columns in various forms, but no doubt the simplest is for each machine to have its symbol A^1 A^2 A^3 for one class of machines, as lathes, and each pattern to have a progressive number, 1, 2, 3, 4, each pattern and its core-box being stamped A^1 No. 4 or A^1 No. 20, according to the number of parts. The drawings bear these same numbers and symbols for the cast-iron parts. Forgings should be marked with the letters of the alphabet, commencing with A, B, etc.

A book containing the list of patterns is kept constantly entered up for reference.

In every machine some parts are used which may be similar to those of several machines, and a separate sheet is advisable for them, a copy of which should be in the store-keeper's possession. For example, hand-wheels can be reduced to a number of sizes, with a standard bore, length of hub, and no departure made from them; also countershafts, fast and loose pulleys, and cones can be simplified in a few sizes. In fact, we could by constant efforts reduce a lot of pieces to standards that can be got out in quantities and put away finished in the stores without reference to the machines on which they are finally to be used. Even in a small works, any one who attempts this will be surprised at the results and the amount of duplication possible. Pulleys, gears, cones, hand-wheels, handles, brass bearings and bushes, and many other things, can be made in quantities and put in the store until at last making a machine is more like a collection of parts and arranging together by the fitter. At any rate, a fitter's time will be saved enormously by all these small things being ready, and a chance of effective piece-work system attempted in getting out the parts.

To enable the store-keeper to know just how his stores stand, and to show what quantities to order of each part, a list is hung in his stores as follows:

We will take hand wheels for an example:

DIA.	MACHINES USED FOR.	$A^1-CB^2-B^2-D^1-G^4-L^{1\,0}-$	$C^3-G^4-L^2-M^1$
6in.		$A=\frac{3}{4}$ $B=1\frac{1}{2}$	$A=1$ $B=2\frac{1}{4}$
8in.			

As he knows what machines are on order, reference to his list will show if he is warranted in ordering the parts in large or small numbers. Diagrams as above should be made for all standard things, and the object of a draughtsman should be to use these standards in "compiling" (I don't say designing—it is too high-sounding for three-fourths of what is generally termed designing) his machines.

Countershafts offer the best subject for the above system. Pulleys of the required diameter and width can be stacked in the stores, and when a machine is completed, and before going out, the parts—hangers, bearing, soil drippers, shafts and pulleys—are given out, and the final putting together done in some minutes, whereas I will offer the statement that a countershaft produced under the usual plan will cost enough more to pay a good share of the store-keeper's wages for one week.

We now come back to the store-sheets referred to for the different parts of the machines. These constitute a complete list of all the parts, however small they may be, used in the construction of the machines. The list of castings corresponds with those in the pattern books. The forgings are distinguished with letters, while the screws and bolts are marked by dimensions taken from the drawings. The miscellaneous parts, of course, vary according to the nature of each machine.

By referring to the store-sheets, as partly shown below, it will be noticed that there is a column to the left of the one which specifies the exact number required; into this column are entered the number of pieces received by the store-keeper from time to time, either from the foundry, smithy, or other source. By this means it is shown at a glance what pieces are short in any particular machines at any time. In some cases a larger number of pieces come to the stores, in the shape of castings and forgings, than are wanted for the set of machines indicated, in which case they are placed in the outside column, under the head of "surplus stock." The next time similar machines are put in hand, the previous store-sheets show where any of the material is to be found in the stores, as is shown by the surplus list.

The screws and bolts, according to the list, are selected out and placed either in a bag or box, and labeled with the machine for which they are intended, and, when given out to the fitter, they represent all the screws and bolts necessary for the machine in progress; and the fitter then becomes responsible for them all. The same thing holds good for the miscellaneous parts.

The store-sheets also show the cost of different parts as well as the correct weight of each. One of the chief advantages—or, perhaps, the most important—is that the sheets cause to be discovered, long before the machines are advanced, what material and parts are required, and, if carefully entered up, will ensure no delay in the progress of the machine through the works.

It is rather difficult to describe the entire system of preparing the sheets, as they vary according to the class of work. For the sake of illustration now, we will assume that the sheets are being prepared for an engine of any particular size, say, 6×10 cylinder. They would then be filled up according to the enclosed list. The engine now in hand is the first one—or $1SE^2$; the next (perhaps a set of three) will be $2SE^2$. The forgings follow, and are described, as are thec a stings.

Noticing first the sheet for castings, we see that most of the pieces have been received into the stores from the foundry, except the "cross-head" and the "eccentric slide," which require the store-keeper's attention. We notice also that there have been five brass adjusting strips, and, as only two are wanted for this order, three of them

SYMBOL, $1SE^2$.—STORES SHEET FOR ONE 6in. × 10in. STANDARD ENGINES.

SURPLUS.	QUANTITY IN STORE.	REQUIRED NUMBER.	CASTINGS.	REMARKS.	SYMBOL.	WEIGHT.	RATE.	COST.
.....	1	1	Bed or frame	.....	No. 1	450	4 cts.	
.....	1	1	Cylinder	.....	2	130	4 "	
1	1	1	Cylinder cover	.....	3	20	4 "	
..	.....	1	Cross-head	.....	4	...	30 "	
3	2	2	Adjusting strips	Brass.	5	6	30 "	
.....	1	1	Cap to bearing	.....	6	12	30 "	
.....	.....	1	Eccentric slide	.....	7	.....	4 "	
					8			

SYMBOL, $1SE^2$.—STORES SHEET FOR ONE 6in. × 10in. STANDARD ENGINES.

SURPLUS.	QUANTITY IN STORE.	REQUIRED NUMBER.	FORGINGS.	DIAMETER.	LENGTH.	REMARKS.	SYMBOL.	WEIGHT.	RATE.	COST.
....	1	1	Piston rod	$1\frac{1}{4}$in.	18in.	Steel .	A	10	12 cts.	
.....	.....	1	Connecting rod	.....	.....	Forge	B	.....		
.....	1	1	Main shaft	$2\frac{3}{16}$in.	36in.	.....	C	40		
.....	1	1	Eccentric rod	$1\frac{1}{16}$in.	40in.	... ..	D	12		
.....	.....	1	Valve stem	$\frac{7}{16}$in.	12in.	.....	E	.....		
.....	1	1	Crank pin	.....	.....	Stores	F	.....		
.....	2	2	Pins in rods	... ..	.....	Stores	G	... ..		

SYMBOL, $1SE^2$.—STORES SHEET FOR ONE 6in. × 10in. STANDARD ENGINES.

QUANTITY IN STORE.	REQUIRED NUMBER.	SCREWS AND BOLTS.	DIAMETER.	LENGTH.	HEADS.	REMARKS.	RATE.	SYMBOL.	COST.
8	8	Cylinder to frame	$\frac{3}{8}$in.	3in.	Hex.				
8	8	Cylinder cover	$\frac{3}{8}$in.	2in.	Hex.				
....	6	Adjusting slide	$\frac{3}{8}$in.	2in.	Sq.				

SYMBOL, $1SE^2$.—STORES SHEET FOR ONE 6in. × 10in. STANDARD ENGINES.

SURPLUS.	QUANTITY IN STORE.	REQUIRED NUMBER.	MISCELLANEOUS PARTS.	REMARKS.	SYMBOL.	WEIGHT.	RATE.	COST.
.....	2	2ft.	$\frac{3}{16}$in. Asbestos packing	Stores	30			
.....	30	30ft.	$\frac{3}{4}$in. Lagging	.....	31			
.....	6	6ft.	Russian sheet-iron	.....	32			
.....	2	2	1in. Lubricators	Stores	33			
.....	1	1	Cylinder oil cup	Stores	34			
.....		3	Piston rings	.....	35			

are carried to "surplus stock," which will appear when the next lot of engines comes forward.

It will be noticed that the "crank-pin" and the "pin in the rod" are marked from the *stores*. This means that these pieces are not made one at a time, but are purchased from outside in quantities, or are made in the works, a number at once, and delivered to the stores to be distributed thence to each machine.

It will be seen that the "connecting rod" and the "valve stem" have not been delivered to the stores.

Screws and bolts come next, and only a few entries are made to show the idea. The set screws, it will be seen, for the "adjusting slides," $\frac{3}{8}$ in. by 2 in., are not entered, which will show that the stock of these sizes is wanting, and the store-keeper will order them at once.

The miscellaneous parts explain what is to be collected for the engine and delivered to the fitter, when it is nearly completed. We notice that the "piston rings" are short.

I have not filled in the lists as completely as they might be, for your readers can readily supply the rest, and this sort of type-setting is expensive.

When these store-sheets are completed, or, in other words, when all the material is collected together and passed into the works, they are handed over to the cost-keeper, who then has a correct inventory of all the parts of the machine, and no mistake can occur from wanting proper entry.

To be ready for any objections as to complication of detail which your readers may imagine, I may say that this system has been in use with us for three years, and at the present time the sheets represent, in my works here, the details of over 120 different machines of large size in process—no doubt meaning several thousand parts, all of which come along as they are wanted, like a procession. In building our new works, we made ample provision, by arranging a room 64 ft. by 20 ft. completely filled with racks and shelves. For this, and to keep materials in order for 200 men, a store-keeper, an assistant, and three lads are necesssary.

Atlantic Works, Broadheath, Manchester.

Saunders' Key Nipple Chuck.

Probably those with experience in cutting pipe have had occasion to complain of the lack of a good chuck, for holding nipples while being threaded, more than of any other tool they are called upon to use. The engravings presented with this represent a new chuck, put on the market by D. Saunders' Sons, Yonkers, N. Y., which, it is claimed by the manufacturers, will remove all cause of complaint in this direction. Referring to the engravings:

Upon the enlarged outer portion of the head a sleeve is fitted to slide, the interior of which, at its outer extremity, is contracted to a conical shape. Placed against the end surface of the head, and within the conically-formed portion of the interior of the sleeve, is a conical ring, the inner surface of which is threaded, for the threaded end of the nipple to screw into. This ring is divided on one side, in such manner that when it is compressed by pressure applied to its circumference its internal diameter will be diminished, gripping the nipple. The sleeve has slots at its opposite sides, and the head has slots to correspond with the slots in the sleeve. The wedge, or tapering key, is adapted to be driven through the slots in such manner that it bears against the ends of the slots on one side of sleeve, and against the end of slot in the head on the other side. The key, when driven inwardly, draws the sleeve in and compresses the divided ring upon the nipple, holding it firmly against turning. The ring end of the nipple may also abut against the end of head, when brought into position to be gripped by the divided ring.

To get the nipple out, after being threaded, the key is driven back, which allows the sleeve to move forward, permitting the divided ring to expand and release the thread on nipple, so that it can be taken out with a short wrench (using no tongs to mar the thread on the nipple). The chuck is provided with a set of rings, one for each size pipe it is to hold; the threads corresponding in size and pitch with the threads upon the nipples.

The chuck shown in Fig. 2 will hold either right or left-hand nipples, but the one shown in Fig. 1 is recommended where many left-hand nipples are required. This chuck, as will be seen, is provided with two keys for holding left-hand nipples. The second key moves a sliding block and ram attached, which works within the hollow head. This key, when driven inwardly, forces outward the sliding block and ram, crowding the ram into the open end of the nipple, so that its radial projections bite into the inner surface of the end of the nipple, and thus prevent its being turned out of the internal ring, which grips it. The ram and sliding block are prevented from turning by the key, which passes through the slot in the sliding block. When used to hold right-hand nipples the ram is not employed, the solid ring being placed over the hollow end of head for the nipple to abut against, and one key being used for compressing the divided ring, as previously described.

FIG. 1.

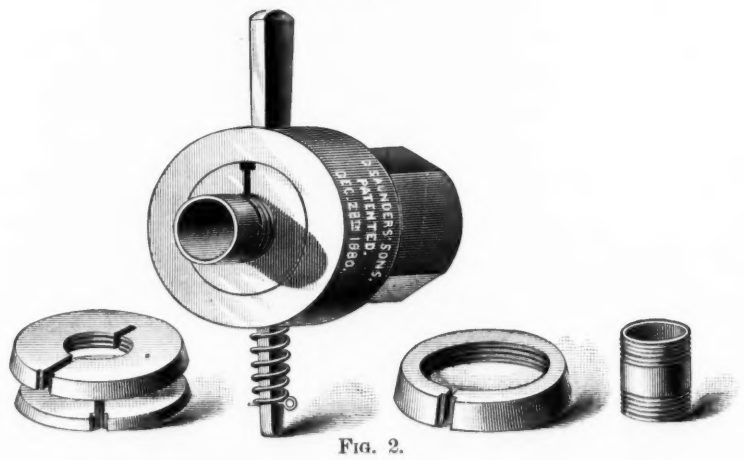


FIG. 2.

George E. Dyer.

The recent death of George E. Dyer, of Calais, Me., came with painful suddenness upon his many friends, and especially to those in the city of Portland, where he had so long resided, and where but a few weeks previous he had visited, apparently in better health than he usually enjoyed. In his death, all who are identified with the advancement of mechanical and industrial pursuits have lost one, who although comparatively young, had given every promise of rising to high rank in his chosen vocation, and as evinced by the examples of his skill left to us, of making for himself an enviable reputation, as he had all the requisites for his particular field of labor, except that most precious one of health. He was ever ready to adopt new ideas, patient in investigation, showing a keen perception as to the utility and proportion of the parts of machinery, always careful in planning his work, and uniting with all, correct methods.

His mechanical education, in the shops of the Portland Locomotive Works, had given him a secure foundation upon which to start in his career, and afterwards in the drafting room of the same company, ample opportunities to acquire a varied knowledge of the details of machinery, comprising almost every department of mechanics. With such advantages, painstaking and anxious to excel, there is no doubt as to what his future would have been, had he lived to more fully demonstrate the results of his experience and talents. The work he had already accomplished, in the specialty of marine engineering, examined as a whole or in detail, gives ample evidence of the sagacity and forethought displayed, not only in general design, but in careful proportions.

Mr. Dyer was born in Portland, Me., but when quite young removed to Calais with his parents, where they now reside. He came to Portland again in the spring of 1863 and began work in the pattern shop of the Portland Locomotive works, remaining there one year, when he was removed to the machine shop, where he worked until the spring of 1865, when, more help being needed in the drafting room, he was selected, having given satisfaction in both of his former positions.

Here he remained with some few exceptions until 1877, when, work being slack, he sought employment elsewhere. But in these years of steady industry and application he had become an accomplished draftsman. The Portland Company during this time had built a number of marine engines, and on many of them—more particularly for the menhaden fishery—he was assigned the duty of making the drawings, a task which he performed in the most satisfactory manner. After leaving the Portland Company and until the Winter of 1881, he was employed in several establishments, one of which was the Portland Machine Works. While there, among other work, he made the drawings for two beam engines for side-wheel steamers, which added not a little to his experience. In 1879 this establishment closed up its business, but employment was offered him by the Maine Beet Sugar Company, then starting a factory in Portland, and afterwards by a similar company in Franklin, Mass., he in both cases receiving the praise merited by his attention and care.

In the Winter of 1881, the Portland Locomotive Works, in addition to their already large orders for locomotives, took the contract for a 60″x12′ beam engine, for a steamer for the International Steamship Company. They had neither drawings nor patterns for an engine of this size. Mr. Dyer was then unemployed, and his services were obtained or this work. He entered upon his duties with his accustomed earnestness, giving the matter his whole time and attention, not allowing the minutest detail to escape its proper share of consideration. The steamer was completed in August, 1882, and the engine was pronounced one of the finest pieces of marine work, for beauty of design and proportion, on the coast. It also showed conclusively what rapid strides he had made in his profession, and his adaptability for works of this nature.

Before he had completed this work, he had been engaged by the Lockwood Manufacturing Company, at East Boston, Mass., to take charge of their drafting department. This company did a variety of work, among other things marine engines. They also took the contract for building the Cape Cod canal soon after he went there, and constructed a very large dredge, which was put into operation early in the present spring at Sandwich. It was through exposure while there attending to some changes in the machinery that he took the violent cold that terminated so fatally.

Mr. Dyer was a man of very correct habits, quiet in his manner, never seeking public notice, consistent, having charity for the errors of others, never wishing to put the burden of his own upon the shoulders of another. Never strong or robust, his physical system was not proof against the pulmonary disease which developed itself and finally resulted in his death. He had the happy faculty of making friends wherever his duty called him, and also of discharging his obligations with a fidelity and thoroughness that could not but commend itself and create a feeling of respect and esteem for him that was most worthily bestowed. It is sad, indeed, to think that death should have removed him at a period when he was giving such practical proofs of his capabilities as an engineer and so rapidly enlarging his sphere of usefulness.

M.

Portland, Me., May, 1884.

As is well known, there is a device by which members of a deliberate body may vote simultaneously by electricity, and have their vote, "yea" or "nay," recorded at once by an indicator on the clerk's desk, thus saving much time. But it has not been put into practical use, for the very simple reason that the free and independent legislator seldom cares to vote independently. He wants to know how the others, or at least some of the others, have voted before he makes up his mind, and the electrical device mentioned interferes sadly with this. Then again, the ordering of the "yeas and nays" is usually done for the sake of wasting time, and time-saving devices, no matter what their merit, are considered altogether superfluous and unnecessary.—*Electrical Review.*

The Houston (Tex.) *Post* says: "W. E. Phillips, division master mechanic of the Texas and St. Louis Railway, tendered his resignation some time ago, to take effect on the 15th ult. Mr. Phillips is one of the most popular men ever stationed in Tyler on any road, not only with railway men, but with everybody. It is rumored that he will take service with the Kansas and Gulf Short Line people. Pat Mylam will be the new master mechanic of the Texas and St. Louis."

A Boston & Albany Railroad car, which was used to convey part of the Master Car Builders to the Saratoga Convention, possesses some novel features. A blind fastener on the car keeps the blinds in positions by means of magnetism. An ordinary spring roller blind is used, and the foot of the blind is weighted with a bar of magnetized iron which projecting beyond the sides of the blind adheres to two vertical iron rods attached to the window-post. The trucks of the car are fitted with quadruplicate elliptic springs. each half of a spring being composed of one leaf tapering in thickness from the center to the ends. This plan gives a quick action to the spring. The inside of the car is very handsomely finished, several departures from ordinary design having been made.

The Indicator Diagram.

By F. F. HEMENWAY.

EFFECTS OF SMALL STEAM PIPES.

Diagram 25 is offered as illustrating some of the evils of the use of a small steam pipe with an automatic cut-off engine. This diagram was taken from a 12″x30″ engine, running at 95 revolutions per minute, steam being supplied through a 2½″ steam pipe 30 feet long, with three elbows in its length. This engine replaced a smaller one, the steam pipe already up being used for the larger engine on the indisputable plea that "more steam would pass through a hole 2½″ diameter than four boilers the size used could supply." At first the speed of the engine was 80 revolutions, but was afterwards changed to 95, to get more power. The power still being at times unsatisfactory, an engineer was consulted, who took several diagrams, of which the one shown in Fig. 25 is a fair sample. As will be seen, the initial pressure was 15 lbs. less than boiler pressure, and this pressure fell off 15 lbs. more before cut-off commenced, this low initial pressure and fall of pressure afterwards, delaying cut-off till a little later than half-stroke.

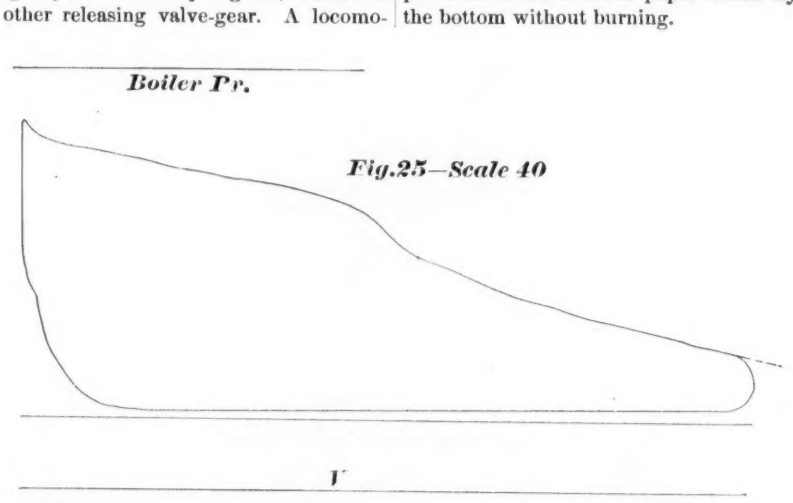
At the recommendation of the engineer, a 4″ steam pipe was substituted for the 2½″; and with all other conditions as nearly like those existing when diagram 25 was taken, diagram 26 was taken. This diagram shows the initial pressure to have been only 3½ lbs. less than boiler pressure, a good steam line and cut-off but little later than one-quarter stroke.

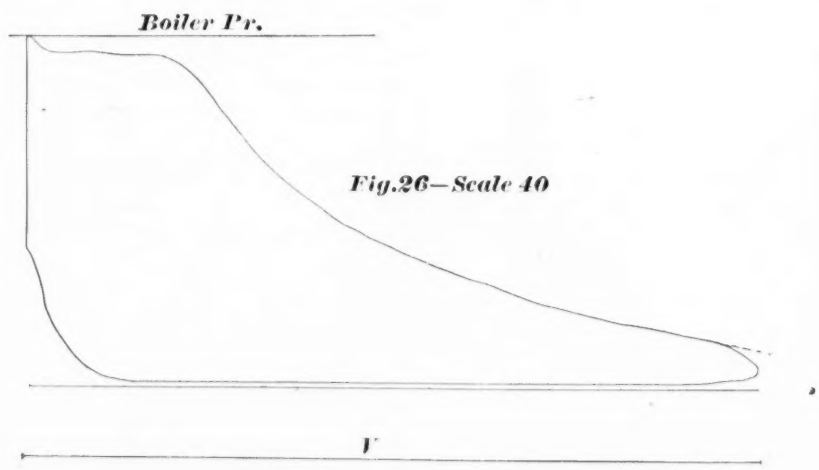
Diagram 25 is bad, for two reasons, the first of which is that it represents, as compared with 26, a waste of steam. To show, approximately—near enough in many cases for all practical purposes—the percentage of waste it is not necessary to know the clearance, nor to take into consideration the displacement of the piston. For since the clearance is the same, and the compression substantially alike, in both cases, the steam saved by exhaust closure will be the same, and any calculation that does not take account of this saving will represent the percentage of loss less than it really is. With large clearance space and high compression the error arising from not deducting the steam saved by compression, in a comparison of this kind, might be considerable, but in the present case it will be less than two per cent., and in the right direction; that is, a direction not to make too strong a case. To make the calculation, referred to, continue the expansion curve to the end of the diagram as if the exhaust had not opened, and represent the volume of steam in both cases by—for convenience—one cubic foot. The terminal pressure is 29 lbs. in diagram 25, and 24 lbs. in 26. From steam tables it may be found that a cubic foot of steam at 24 lbs. pressure weighs 17 per cent. less than at 29 lbs. pressure, so without accounting for steam saved by exhaust closure (which would slightly increase the percentage) 17 per cent. less steam was used when diagram 25 was taken than when 26 was taken. The area of 25 is less than 4 per cent. greater than that of 26, so with the large steam pipe 17 per cent. less steam is used to do 4 per cent. less work and a saving of 12½ per cent.—to be quite safe, say 10 per cent.—was effected by the large pipe.

The second reason why diagram 25 is bad is scarcely less important than the first. This diagram shows, by comparison with 26, to what extent the small steam pipe has decreased the capacity of the engine. The cut-off in 25 is almost at the extreme limit of the valve gear, and this diagram may be said to represent the utmost capacity of the engine with 75 lbs. boiler pressure. With a slight fall of pressure the engine would not run to speed; in fact, running under the conditions indicated by the diagram, in changes of load, such as throwing on machinery that had been thrown off, it would be found that the governor had but little control of the speed; in other words, that the engine would be very slow in getting up to speed. The loss in this respect might be greater than the loss of steam. With the large steam pipe there is a fair margin for governing, either when the steam pressure is reduced or when part of the load is thrown on suddenly, because the cut-off may be, if necessary, as late as in 25.

A Detroit dealer in windmills had a visitor the other day who looked one of the machines all over with a critical eye and asked numerous questions, about how long it would last and what it could be expected to do. Seemingly satisfied on these points, he observed:

"Well, the price seems to be reasonable enough, and now let's see what it will cost for a steam engine to drive it."—*Detroit Free Press.*





LETTERS FROM PRACTICAL MEN.

Corliss Valve Gear on Locomotives—The Use of Zinc in Boilers—Boiler Setting.

Editor American Machinist:

There seems to be a large number of engineers who think that because the Corliss valve gear has worked so well on slow running stationary engines, it might be applied to locomotives; whereas it is not applicable to high speed stationary engines, neither to any other releasing valve-gear. A locomotive valve-gear must be simple, as it is covered with rain, snow or sand, and it is doubtful if the link motion can be improved upon when the cutting-off and reversing are taken into account. But is it not possible to improve on the valve, and instead of using a slide with its great friction, wouldn't it be advisable to try the piston valve as used in the fast steamships, or the Armington & Sims high speed engine?

These valves are frictionless, so far as the steam pressure is concerned, are easily and cheaply replaced, while the ports can be short like the Corliss, so as to reduce the clearance to a minimum, and be of ample size, keeping the initial pressure and steam line up nearly to boiler pressure, with a fair prospect of getting the point of cut-off more sharply defined.

Mr. Marshall, in a recent number, tells us that zinc is a good thing to prevent incrustation in boilers. Will he please tell us how to use it, as I know of a man who, on reading that zinc was a good thing, and having some in scrap at hand, put a shovel full into the front hand hole plates of his boilers, and the next week the boiler makers put on some patches. In another case a man put a strip of zinc in his boiler, which lay on the bottom, and he had a case of internal grooving, although he saw it before much injury was done.

The combustion is about eight pounds of coal per square foot of grate per hour. This would indicate that the heat was insufficient to ignite paper at the bottom of a four foot space, or that the combustion in furnace was so complete that nothing but carbonic acid passed over the bridge wall.

W. E. CRANE.

Waterbury, Conn.

Steel for Locomotive Fire Boxes.

Editor American Machinist:

In one of your recent issues there is a paragraph on copper plates still being used for making the fire-boxes of English locomotives, and the writer thinks that the reason why our British cousins have not got to using steel is because they never tried just the right kind of material. I am disposed to think that they do not use steel because they have never got into the proper way of working the plates into fire-boxes. Steel-makers have got their operations worked down so fine that they have no difficulty in preparing sheets of any quality desired, but even the best-selected steel will not give satisfaction in fire-boxes unless special care and skill are used in putting them into shape. When steel fire-boxes were first tried among us, there was a great deal of trouble with cracking of the sheets after the engines were in service. This rarely happens now unless I speak of this as there are men who try everything they read whether they understand the manner of applying it or not, and who do not appear to possess the necessary judgment to use even reasonable discretion.

On the subject of bridge walls I am seeking for information, and would gladly give any of which I was possessed, but my experience has been chiefly confined to sectional boilers. In the case of the furnace mentioned by me, I gave the figures as the result of an evaporative test. It is claimed by some, and disputed by others, that the bridge wall should correspond to the shape of the boiler, so as to bring the flame up around the boiler, and the space back of wall should not exceed eighteen inches in depth. Now, isn't it true, that the hot gases will rise up around the boiler, regardless of the depth under it?

In conversation with an engineer whose tubular boilers are set with the bottom of the space back of bridge wall, level with floor, making a depth of nearly four feet under the boiler, he told me that in this place he threw a lot of paper which lay on the bottom without burning.

carelessness or blundering has left the sheets defectively annealed. In most of cases that I have known of late years, where sheets have cracked, the trouble could be traced to faults of this kind. This leads me to believe that when English engineers use steel for fire-boxes, and do not get it to stand, the trouble is in want of care in annealing, rather than in unsuitable material.

ENGINEER.

Burning Anthracite Screenings with Bituminous Coal.

Editor American Machinist:

In your last issue a correspondent asks, "Can anthracite screenings be burned with bituminous coal?" In reply, I would state that it can be done very successfully by using the automatic stoker, and, in quantities of 50 per cent. each, will make a very elegant fire.

The stoker distributes the coal evenly over the grate, and maintains an even and high temperature in the furnace.

REUBEN S. MILLER,
Engineer for A. M. Collins, Son & Co.,
Philadelphia, Penn.

Danger in Opening the Connecting Valve.

Editor American Machinist:

There would be danger attended if the globe valve connecting the two boilers, as mentioned, was opened all at once, but if time was given so as to equilibriate the two pressures no disastrous effect would be the consequence.

This, in answer to Mr. D. H. Baldwin's and Mr. J. S. Corbin's question inserted in your issue of June 7th, Vol. 7, No. 23.

H. FOSTER, Engineer.

Adria, Italy.

Opening Connecting Valve Between Boilers.

Editor American Machinist:

In regard to the question of Messrs. Baldwin and Corbin, whether the effect of opening a valve between two boilers under different pressures would be disastrous, I should say that, while it would be highly improper, there would be no danger or disastrous results. There would be considerable water carried over to the low from the high-pressure boiler if the valve was opened suddenly and wide, and there would continue to be a loss of water in the same direction till the temperature in both boilers was equal, when there would be about 80 lbs. pressure; three gauges of water in one and one in the other.

P. H. BULLOCK,
Chief Engineer Massachusetts
State Prison.

Stove Polish for Blacking Moulds—An Inquiry About Melting Steel.

Editor American Machinist:

I quote from Mr. West's article in the AMERICAN MACHINIST of May 31, in reference to Bohemian lead: "Not only is this lead used in blacking, but it enters to some extent into the manufacture of stove polish." That clause contains more important information to foundrymen than many will give it credit for, more especially in cases of emergency in foundries that are situated a long distance from market.

Last fall this firm had a $24,000 contract with a company in Fort Worth, Texas, to have certain machinery in operation at a date named, or forfeit $25 per day until in operation.

We had ordered from a firm we had been dealing with in the East, "a perfect wash," at a high figure. It was here on time, and we used it on the first piece—a three-ton casting made in loam. The casting, when taken out of the pit, was found to be sound and perfect in shape, but the worst looking piece of work any moulder ever looked at; great white and yellow *clay*-looking blotches all over it—in fact, most any color but what a nice loam casting should be. Our loam mixture was the same as usual. We examined the wash, and the firm decided to pocket the loss and not use any more of it, nor use that casting for the machine. We had another loam mould ready all but black-washing, and were at our wits' end about the

quickest way to obtain a good article, as we had no time to lose.

I remembered reading, several years ago, the ocmposition of stove polish, and decided to try it. I found a merchant here who had a large lot on hand, containing a good quality of German lead, and bought enough to try on the mould we had up. The result was a clean, beautiful, blue casting of a ton weight. We bought several hundred pounds here, and a ton of a New York firm who had it on hand and had quit manufacturing, for one-third less than we get good loam wash from facing mills. We pound it up, make a thin paste of it, and apply it in the usual way. We have used it on castings of several tons' weight with perfect satisfaction.

I want to ask any reader of the AMERICAN MACHINIST if he knows anything about melting steel in a common foundry cupola. If so, I wish he would make it known. I mean steel alone; I understand the steel mixture. I read in a journal that steel had been successfully melted as above in Belgium, with a very little more heat than is required for cast iron. This firm uses about one hundred tons of steel a year in their plow department, and have tons of steel scrap on hand, which is a dead loss down here. If I don't get any information, I am going to try a small heat, if in nothing but sash weights, and I'll let you know the result. ROBERT E. MASTERS.

Columbus, Ga., Iron Works Company.

Keeping Account of Foundry Cost.

Editor American Machinist:

We wrote you some time ago in regard to our furnace account book, which shows what each heat costs and what each separate item amounts to during the year. Although we have our castings made by the ton, we keep track so we know the amount of labor done each heat, the cost of coal, iron, etc., and we can compare them with any heat made at any previous time by dividing the net cost in statement by the number of pounds of good castings, which shows the exact cost per pound of castings each heat. In estimating the yearly cost, we must, of course, take into account the investment, yet in this way we find practically just what we are doing every heat. The record can be kept just as well when parties hire by the day. Should you think this would be of interest to foundrymen, you are at liberty to use it in your paper. We find it of much value to us, and we know it can be used in many shops to a very great advantage, and we think many foundries can be made to pay that now show a poor footing up at the end of the year. We made this book for our own particular line of business, and the plan might want to be changed some for other foundries, yet we think it suitable for most any foundry. We find your foundry notes are much sought by furnacemen; and, as the machine business and furnace business are so closely connected, there can be but little said on either subject that is not in some way of interest to the other. W. P. DAVIS.

North Bloomfield, N. Y.

FURNACE ACCOUNT—HEAT OF MAY 23, 1884.

ITEMS.	POUNDS.	MISS.	COST.	POUNDS.	REMARKS.
Scotch pig	800	.....	$ 9 20	.....	
American pig	3,000	.....	34 50	.....	
Scrap	800	.....	7 50	.....	
Coal and coke, lbs	.....	500 each.	3 60	.....	
Days moulding	.....	12 days.	28 34	.....	
Common labor	.....	2 "	2 00	.....	Heat consisted of light casting; iron came down sharp, etc., etc.
Waste iron	.....	.....		320	
Gross cost	.....	.....	85 14	.....	
Less sprues, &c	.....	.....	5 00	500	
Amount good castings	.....	.....		3,780	
Net cost	.....	.....	80 14	.....	
Totals	4.600	.....	.....	4,600	

The above weights are correct, and I hereby acknowledge payment in full, for labor, $28.34. JOHN DOE, Foreman.

North Bloomfield, N. Y., May 31, 1884.

A Process of Putting in a New Crank Pin.

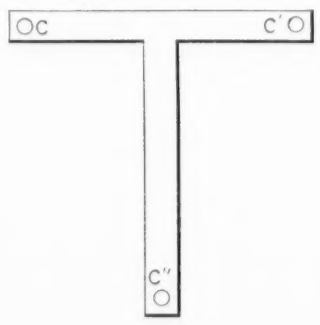
Editor American Machinist:

In my practice recently it was necessary to take a six inch crank-pin out of a Porter-Allen engine, and replace it by a new one. The hole had to be somewhat enlarged to admit the shank of the new pin, and that operation presented a difficulty, as it must be done very accurately, without taking the crank-shaft out of position, and there was no face known to be true, which could be worked from in keeping the hole parallel with the shaft. I finally decided to pursue the following method, which was successful, and may be of use to some of your readers: I first had a cast iron hollow cylinder made, about .002" less in diameter than the hole was to be when finished. I then tapered off one end a very little, so it would enter the hole slightly, drove it in, and trued it with the crank-shaft by trying a level on the projecting portion at four points in the revolution of the crank, and adjusting it until I found a position in which the level would show the same when placed upon it in any position of the crank. By this means I found the true level (or inclination rather) of the crank-shaft. This being ascertained the work of enlarging the hole was begun. I used scrapers and tried the level in many positions in the hole by turning the crank around. This proved the direction of it. As soon as the hole was large enough to admit the cylinder, it was slipped in and used as a surface plate. By rubbing a little red lead on its outer surface the "high" portions were detected. These only were scraped, and such of them as the level showed to be high, until the hole came true to the size gauge. It was then found true (parallel) with the crank-shaft, and well surfaced.

The pin (of hardened steel, ground) was then forced in with a hydraulic jack, and was found to stand right within one-half of one-thousandth of an inch in its length.

Some of your readers may ask how I know it was within so small a measurement of absolute truth.

In reply; it is just as easy to measure one-thousandth of an inch as it is to measure one-eighth of an inch. In the first place, the pin must be true. This is accomplished in the finishing process. Then a level must be used that will measure, accurately, a thousandth of an inch. In the level I used the bulb moves one-eighth of an inch from its central position when the surface upon



which the level rests is deflected one-thousandth of an inch in ten inches.

It may be asked how I know this. Well, the level was placed upon a sort of three-armed surface plate at the Southwark shops, somewhat as per sketch, in which c, c', c'' are micrometer screws upon which the plate rests. The screws c, c' are exactly ten inches apart, and the screw c'' is ten inches from a straight line drawn from c, to c'. The plate was first set level in all directions, then the level placed upon c'' arm, and c'' micrometer screw was moved so as to elevate or depress that end of the plate arm one-thousandth of an inch, and the bulb of the level was found to stand one-eighth of an inch out of its central position. This showed that a deflection of one-thousandth of an inch moved the bulb one-eighth of an inch. But to return to the engine:

The bulb stood about $\frac{1}{8}$th inch out of true position when the level was tried on the pin, one way, and as the length of pin is about 5 inches, the actual deflection shown was not more than one-half of one-thousandth of an inch in its length.

This was easily corrected in riveting up the back, and the pin brought true, probably within one-fifth of one thousandth of an inch. It is possible to set these pins within one ten-thousandth of an inch of their true direction; and I have no doubt it is done. When the variations is .001" in 5" it is a bad job.

I very much doubt whether there is greater accuracy in any class of work—not excepting watch work—than there is on some engines of the present day.

I should be pleased to hear from others on the subject of accurate workmanship.

I will add that the level used for any internal surface, such as the hole in which it was used in this case, must have its resting edges parallel, and must be provided with a cross level to level the level itself, crosswise. ED. F. WILLIAMS.

Why an Engine Pounded.

Editor American Machinist:

In issue of March 1st and 22d was an article on tinkering with steam engines. Although the article was very well answered, I should like to relate an experience of mine, which caused me some tinkering before I got out of the so-called difficulty.

The engine was of the Corliss type, and had been run about ten years when I took charge of it. I had not been there many months before it began to make a peculiar knocking. It was peculiar for this reason: Sometimes it would knock and sometimes it would not. Then, as the gentleman says in your issue of March 1st, I began monkeying with the machine. I tried the bar, then the cross-head and the eccentric, took off the cylinder head, then out with the piston. I tried every bolt and screw about it, put them back and started up. No better. Took the bonnets off, pulled out the valves, but still could not find the least thing out of place after all my trouble.

Next day it was so bad that I was obliged to stop at 2 P. M., and sent to Corliss for one of his best men. He came up, and we spent another night. He said he could see no reason why the machine should not work all right, and, as it did not make any noise when the work was not on, he went away satisfied. But the instant the work was put on the music commenced. It would knock four or five times, and then stop as if to take a new hold.

After two days' thought and two more nights of "monkeying," and one with an expert, things looked rather blue. But find it I must, and did at last, and this was the cause: About a year before I assumed charge they had taken the cylinder off and sent it to the shop to be re-bored, and when they came to put it back on the legs they forgot to tighten up more than one of the four bolts that bolted the forward legs to the cylinder, and that one was broken off, leaving the cylinder a little loose. The instant the first bolt was tightened the knocking ceased, and has not been heard since.

When I saw that piece in your paper of March 1st, that called such things tinkering or monkeying, I could but wish that the writer had been doing that job instead of me.

PACKING.

An understanding of a friendly character is stated to have been arrived at between some of the principal English, Belgian, and German railmakers. It has been agreed that in quoting prices for export their works shall not compete against each other, but, according to a fixed arrangement, distribute the quantities amongst themselves, compensating those who do not obtain orders by some means or other.—*Martineau & Smith's Hardware Trade Journal.*

In other words, the foreign rail manufacturers have formed a pool, and if they could get our protective tariff removed they would help each other to break up the railmaking industry in this country, by selling at prices that would not near pay for American labor and material necessary to make the rails.

Thomas Hughes, in an article upon "Trades Unionism in England," says, in reference to the antagonism between trades unions and employers: "It is satisfactory to note that much of the blindness and bitterness has disappeared. The voluntary courts of arbitration and conciliation may be credited with this result. In them the union representatives get a real knowledge of the difficulties and fluctuations of trade and come into personal relations with employers, by which both sides learn to make allowances. Disputes as to the rates of wages can never cease until the development of association has made the interest of employer and employed identical. When that time comes, trades unions will disappear."

A Royal Commission has been appointed in England to inquire into the instruction of the industrial classes of other countries in technical subjects, compared with that country.

A New Engineers' Society.

"The Mechanical and Practical Engineers' Club" is the title of an association of stationary engineers lately formed in New York City. The main object of organizing is to urge the enforcement of the new law passed by the Legislature, which divides stationary engineers in this city into three grades, each to pay $2 to the "Police Pension Fund" every year for a license. Another object is the "mutual elevation, benefit and protection of its members, discountenancing any project or enterprise that would threaten or interfere with the harmony of the same."

No political or religious discussions are permitted at its meetings. The officers are: James Morrow, president; James Barnes, vice-president; J. H. Fisher, secretary; and E. J. Wood, treasurer. The following officers and members constitute the Board of Directors: James Morrow, E. J. Wood, Jas. Barnes, J. H. Fisher, Theo. Jennings, Jas. F. Wilson, James Rutter, Daniel Cary, Wm. O. Cloyes, Chas. E. Rankin, W. H. Lee, H. H. Nelson, Samuel Rushworth, John E. Drew, G. A. Traver.

We feel constrained to say, in answer to a pleasant communication from one of the editors of the *Bolt*, an annual, published by the students of the Stevens Institute of Technology, and briefly noticed in a recent issue of the AMERICAN MACHINIST, that we shall take back none of the good things we said of it. We even advise those who believe in the use of many adjectives to supply them in our previous notice, *ad libitum*. We mean such adjectives as tend to intensify the quality of goodness. Our bachelor editor would probably, in his brief review, have scattered our limited supply of adjectives with more freedom, but for the fact that he became so engrossed in contemplation of the presentment of female loveliness that adorns one of the initiatory pages as to never turn beyond it, except by accident. It is not true, however, that he insinuated that the *Bolt* was an *Eccentric* bolt. The *Bolt* isn't a part of anything. It is whole—or fills the hole—and is *prime* in every particular, even to the classical Hoboken musquito. By the way, no better idea of the magnitude of the engravings in the *Bolt* can be had than a consideration of the fact (which we know from actual measurement) that that musquito is shown on a scale three inches to the foot! The *Bolt* isn't *steal*, but it don't break nor strip its thread. We are also glad to hear that it isn't likely to break its publishers.

Fuel Economy with Locomotives.

BY ANGUS SINCLAIR.

A PAPER READ BEFORE THE RAILWAY MASTER MECHANICS' ASSOCIATION AT LONG BRANCH.

To the American Railway Master Mechanics Association,

GENTLEMEN:

During the last twenty years remarkable reduction has been made in the cost of moving railroad trains, and an important portion of the saving effected in transportation expenses is due to the labors of this association. While there is just ground for pride over past achievements, the work must still go on, for great progress must yet be made in the line of economy.

We have heard much said of late about the keen, close competition which our food producers are going to encounter in the near future from the breadstuffs raised by the cheap labor of Russia and India. A factor in this problem, perhaps more important than the original cost of production, is the cost of handling and transportation to market. The vital struggle in this race will probably be decided by taxing the ability of our railroads to make still greater reductions in the cost of moving the produce of our Western farms to the seaboard. As the locomotive department nearly always receives the first attention when a demand for reducing operating expenses arises, I shall endeavor to suggest how important savings might be effected without impairing the efficiency of the service.

Although the American locomotive compares favorably with the average stationary or marine engine in the economical application of power, there is still room for improvement, as can be proved by a comparison with the work done by locomotives in Europe of similar dimensions to ours, while doing similar work.

During the month of March last the engines running the Chicago Limited Express on the Pennsylvania Railroad, between Jersey City and Philadelphia, burned 63.35 pounds of coal per train mile. Some engines on other roads doing similar service, and burning bituminous coal, show a slightly better duty; but the Pennsylvania locomotive may be accepted as a fair average of American locomotive practice, with two or three notable exceptions. On a good representative road in this country a Mogul engine, with cylinders 18×24 inches, pulling twenty-five loaded cars, on an average, burns 120 pounds of coal per mile. This may be considered among us, fair economical work for a freight engine.

The famous Webb compound locomotive, on the London and North-western Railway, has been running a train of about the same weight and speed as the Pennsylvania Railroad's Chicago Limited Express over a road quite as hard to operate, with a fuel expenditure under 30 pounds to the mile. This engine may be regarded as having exceptional means for steam saving, but the best engineering authorities in England contend that its performance is no better than that of many good locomotives that are not compounded. The "Gladstone," a well-known engine belonging to the London, Brighton and South Coast Railway, having cylinders 18½×26 inches, burns 31 pounds of coal to the mile while running an express train weighing about 200 tons at a speed of 45 miles an hour. From the record of work done by engines on the Great Northern Railway, I find that a freight engine, with cylinders 18×26 inches, pulling a train similar to that handled by the Mogul, already referred to, and over a road whose physical features are nearly the same, does its work with a fuel consumption of 50 pounds to the mile. Many attempts have been made to explain away the unfavorable fuel record our engines make compared with those in Europe of the same size doing similar work, but these well-meaning attempts have not been convincing. If other engines are making a better record than ours, our best way towards equaling or excelling them is to recognize the truth and investigate the cause. Considerable experience with the running of locomotives on both sides of the Atlantic, leads me to believe the allegation, that greater expense is incurred in operating our locomotives than is found necessary with British engines, to be genuine, and founded on undeniable data. I shall endeavor to point out some of the causes which I think contribute to this undesirable condition of affairs.

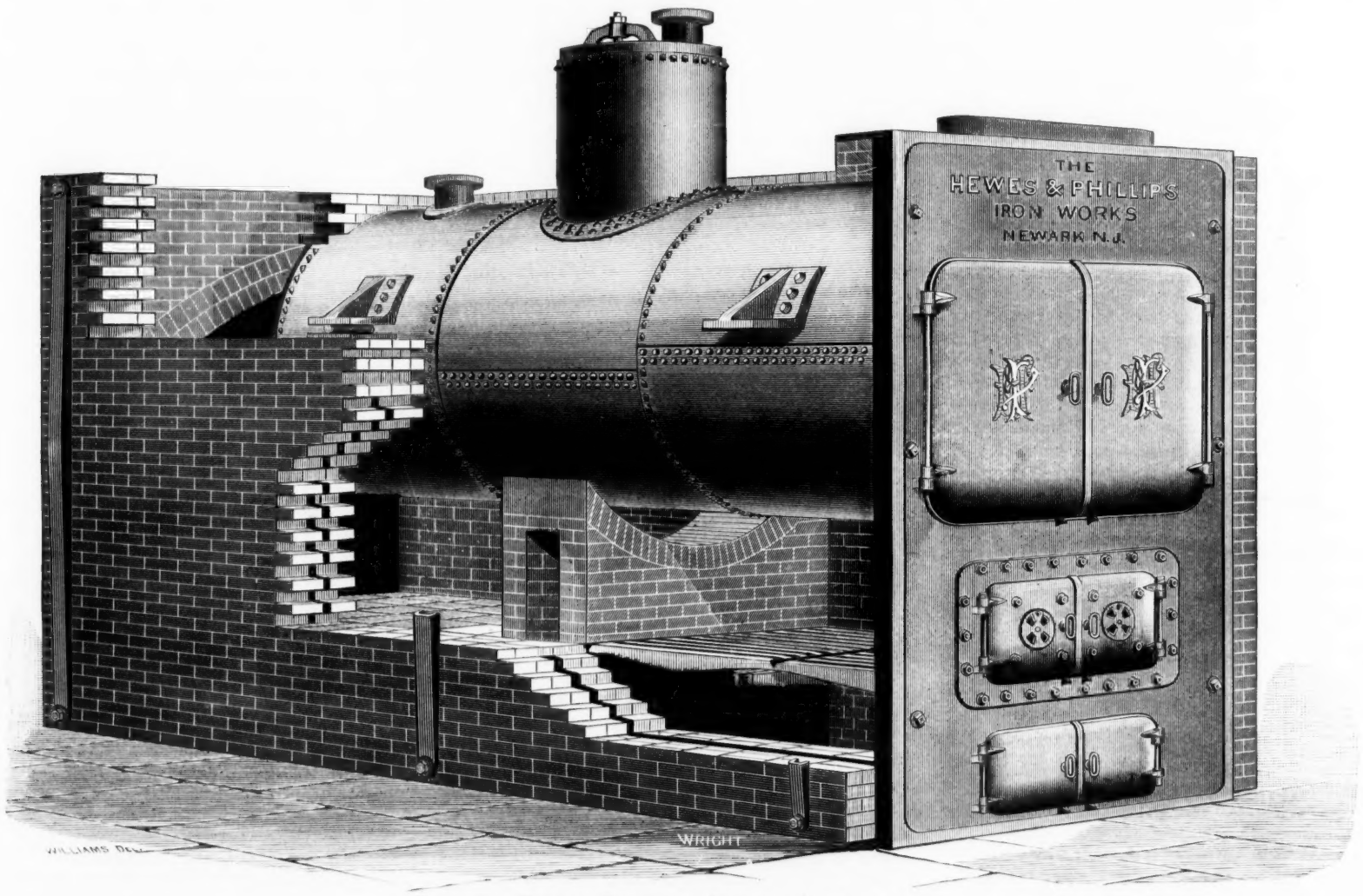
Proper investigation would probably identify several causes as contributing to the unfavorable record of the American locomotive. However good an engine may be, it is not likely to make an economical showing unless the men in charge are interested in bringing about that result. The American locomotive engineer and fireman are second to none following the same calling for intelligence and high character, but they are not trained up in the rigid ideas of fuel economy that prevail among the enginemen of Britain. There are roads here where strict economy is habitually practiced, but they are exceptional. The average fireman on the ordinary run of roads gives no heed to coal-saving, his work being regarded as good so long as he keeps up the required head of steam. Before firemen can be blamed for this laxity, an examination of the means at their command to promote fuel-saving is necessary. An important item of heat waste is the steam thrown away through the safety valve. Now, what aid has the fireman received from the locomotive builders and designers in restraining this source of waste? The ordinary ash-pan is made without pretense at being air-tight, and to call its doors dampers is a delusion and a snare. There is also a greater evil in this than the mere loss of heat by steam blowing off. Firemen are prevented from learning the practice of regulating the admission of air to suit the fire, so they fall into the habit of making the fire suit the full admission of air.

Let us suppose that every pound of coal consumed in the fire-box is capable of generating 14,500 units of heat, combustion being effected by the oxygen taken from twelve pounds of air. In this case there would be thirteen pounds of mixed gases heated by the heat liberated from the single pound of coal, elevating the temperature to 4700 degrees Fahr. But locomotive fire-boxes when the engine is working need a liberal supply of air to effect complete combustion, and 18 pounds of air to the pound of coal is low for the intense draft of our engines. To heat up nineteen pounds of gas, one pound of coal will not raise the temperature higher than 3200 degrees Fahr.—a loss of 1500 degrees below the other, and every additional pound of superfluous air cools the gases of combustion in like proportion.

My object in adverting to this well-known fact is, to allude to its practical effect on our loose methods of controlling air admission. When an engine is working with a heavy fire, more air is needed to penetrate the mass and effect combustion than is necessary where a light fire is carried. But our practice is to give the same supply for both cases. The consequence is that an engine will not steam with a light fire, because the rush of air is so great through the thin coating of coal that the gases are chilled below the point of ignition. In approaching stations or long descending grades, firemen could often let the fire go light if they could regulate the admission of air by proper dampers as their compeers on British engines are enabled to do. This practice of permitting a free rush of air through locomotive grates at all times is responsible for more waste of fuel and damage to fire-box sheets than is generally recognized.

What appears to be another source of loss with us is the practice of using viciously contracted exhaust nozzles. When we reflect that induction of furnace draft by exhaust steam, is subject to the same laws that regulate the induction of a current of water by the steam jet of an injector, it seems a curious spectacle to see the exhaust steam passed from the pipes through two parallel nozzles neither of which can be central to the lift pipe or stack that the steam must use as an induction pipe. This I conceive to be a violation of the laws controlling induced currents, and its bad effects have to be remedied by resorting to means which entail other disturbing agencies. Any one who has tried to make an injector work when the internal tubes were out of line knows that he had a difficult job to accomplish. An engine with double nozzles is in the same position in regard to draft induction as the injector is in regard to its ability to throw water when the tubes are out of line. The exhaust steam does not go straight up the stack, acting like a piston to form a clean vacuum behind. Its tendency is to strike on the sides of the stack or pipe, breaking its unity, reducing its velocity, and leaving fragments of the volume behind. To overcome this obstacle to free induction, increased speed of exhaust steam is resorted to which is obtained by contracting the nozzles. This increased speed of exhaust steam is rendered necessary to prevent the scattering steam from destroying the vacuum in the smoke-box. This is not a mere hypothesis. It is the teaching of observation and experiment with engines at work.

The single nozzle is almost universally



HORIZONTAL TUBULAR BOILER AND SETTING.—(See page 7.)

used in Europe. An ordinary engine with cylinders 17×24 inches will steam freely with a nozzle 5 inches diameter, giving an opening of 19.6 square inches. On the Elevated Railroads of New York, single nozzles are employed, and their standard engine with cylinders 11×16 inches steam freely with a nozzle 3 inches diameter, or 7 square inches area of opening. That cylinder has a cubical capacity of 1520 inches. Where double nozzles are used their diameter for a cylinder 17x24 inches is about 3 inches. A cylinder of this size has a cubical capacity of 5424 inches. So the steam from this large cylinder has to escape through an opening as small as that which induces draft to make steam from a cylinder less than ⅓ its capacity. The result of this system is that the ordinary locomotive suffers chronically from back pressure in the cylinders due to unduly contracted exhaust orifices.

It may be said that a certain height of smoke-box vacuum must be secured to make an engine steam, no matter what kind of nozzles are employed. But facts do not substantiate that theory. Every one who has tried the two forms of nozzles knows, that steam can be made freely with a much lower vacuum when a single nozzle is employed than in the case of double nozzles. And where a decrease of smoke-box vacuum is practicable a direct saving of fuel is effected through the fire not being torn up so much by the blast. This also permits a steadier fire-box temperature, since the current of surplus air is less fluctuating.

The only advantage claimed for the practice of using double nozzles, is that a single opening allows the exhaust steam from one cylinder to shoot over through the junction of the exhaust pipes into the other cylinder, causing more back pressure than contracted nozzles. This defect is due to a wrong pattern of exhaust pipe. Where the pipes are designed so that the steam is flowing in a nearly vertical direction before the junction of the pipes is reached, there is no trouble from it passing over into the other exhaust pipe. Indicator cards taken from the engines on the Elevated Railroads show no shooting over of the steam, and British locomotives indicate no loss from this source.

The practice very general in Europe of using driving wheels much larger than ours may have some influence on economy of heat. An engine running at a rate of 45 miles an hour having drivers 66 inches diameter, exhausts 15 times each second; an engine with drivers 84 inches diameter running at equal speed exhausts 12 times each second. The effect which the rapid exhausts have upon the fire appears to have received too little attention. When the period between the exhausts is long enough to allow the gases to flow with a pulsating motion, their speed through the flues must decrease between the exhausts. This would permit more of the heat to be abstracted for evaporation. Those who are in the habit of running engines up steep grades with heavy trains, know that so soon as the engine begins to move slow the generation of steam becomes exceedingly rapid, although the engine may be working up to its highest capacity. Heavy work done under such circumstances is performed very economically, which may be due to the slow exhaust permitting effectual absorption of the heat.

While I stand second to none in admiration of the many excellent qualities of the American locomotive, I think there is a possibility of making it lighter on fuel. In working towards that end the points brought up in this paper may be found worthy of investigation.

The Hewes & Phillips Horizontal Tubular Boiler and Boiler Setting.

The engravings accompanying this represent the horizontal tubular boiler made at the Hewes & Phillips Iron Works, Newark, N. J., together with the boiler setting. In the construction of these boilers the rivet holes are punched and then reamed, no drift pins being used in putting them together.

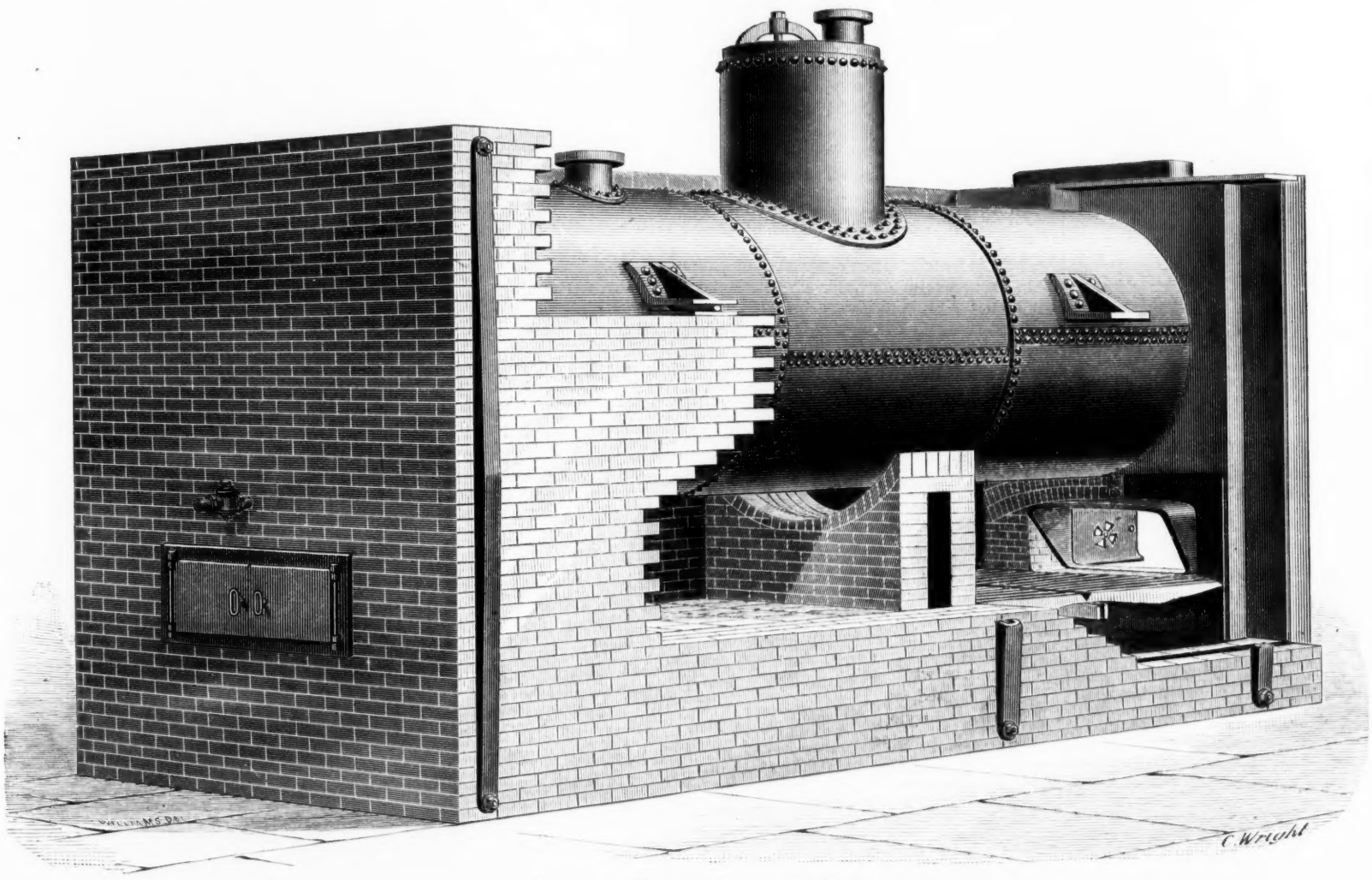
By the method of tube distribution adopted, the center vertical row is left out, which provides a more solid body of water over the fire, and insures better circulation.

Two large man-holes are put in each boiler—one on top of shell and one in the lower part of the front head, thus providing facilities for removing dirt and sediment.

All flanges are turned of a large radius, avoiding danger of fracture.

The fronts are made in sections, being split both vertically and horizontally. This allows for expansion and contraction in use, and avoids the danger of cracking and distortion.

In design of boiler and furnace, as well as in constructive detail, advantage seems to have been taken of existing knowledge of the subject to the end of furnishing, at a moderate price, an economical and first-class boiler of this well-known type.



HORIZONTAL TUBULAR BOILER AND SETTING.

Machinery in Cuba.

From Mr. J. Maire, who has recently returned from Cuba, where for two years he held the position of engineer of a large sugar plantation, we obtained some particulars about the condition of that island. Business is very depressed, principally through the misgovernment to which the people are subjected. There is nothing being done in the way of improving machinery, and, although much of the machinery in use is worn out, no efforts are made to replace it. A double-cylinder engine, which operated the machinery of the principal plantation where he was, had been at work for thirty years, and the cylinders had not been bored out. They were heavy, low-pressure cylinders, 41 inches diameter, made of brass, and hard to handle. They had got into extreme bad order, and he determined to bore them out, although he had not any proper tools. After scheming round, he got an iron car wheel and drilled holes through its tread, into which he inserted cutters. Then he turned an arbor to fit the wheel center, keyed it in place, and used this primitive boring mill with success to true the cylinders. Mr. Maire was for years foreman of one of the New York Elevated Railroad machine shops, so he took special interest in the railroad machinery of Cuba. He reports the plant of the principal railroad out of Havana to be in a wretched condition. Many of the rails have the heads worn nearly off, the cars ride as if they had no springs under them, and the locomotives are so badly worn out that they seldom go over the road without breaking down. With things in this miserable plight, the expense of operating and maintenance is very high.

Arrangements have been made for Naval Constructor Philip Hichborn, now at the Portsmouth Navy Yard making a tour through the principal navy yards of Europe, that he may personally inspect the most recent improvements in naval shipbuilding. His mission is to note the leading changes in tools and methods of doing work that have followed the introduction of steel as a constructive material. It appears that our naval authorities are a little ahead of Congress in their desire to obtain full information respecting the latest improvements in naval construction. It is only a few weeks since a report was submitted to Congress from a board of naval officers that was appointed to visit European naval yards for the purpose of investigating the latest improvements in the construction of steel ordnance. Congress shows little inclination to act on the recommendations of this board, although the report was an excellent document to educate Congressmen regarding the comparative efficiency of our best naval ordnance.

The Atchison, Topeka and Santa Fe Railroad Company are equipping their freight cars with the Westinghouse air brake, and they are doing the work in a very systematic way. A building connected with the company's machine shops at Topeka has been fitted up with the necessary tools and appliances for doing the work, and all the brake fixtures are stored in the same place. They have facilities for putting the brakes on twenty-five cars a day, and a boiler, with an air pump attached, is ready to test the brakes so soon as they have been put on. As the work is done by men who are daily repeating the same operations with the most approved tools for aiding their work, it is done expeditiously, well and at low cost.

An international wool exhibition is proposed for Fort Worth, Texas, in 1887. There is a fair prospect that the enterprise will take definite shape and be carried out.

For a few months past the malleable iron manufacturers have been experiencing a boom of moderate proportions. It is not over yet. They are generally well supplied with orders, and some of them are enlarging.

The *Railroad Gazette*, of June 13th, has information of a total of 122½ miles of new railroad, making 1,032 miles reported to date for the current year. For the same period last year 1,830 miles were built, and for the same period of 1882 3,667 miles.

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NEW YORK, JULY 5, 1884.

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Need of Encouragement for Technical Education.

Three years ago a board of royal commissioners was appointed by the British Government to make a thorough investigation into the subject of technical education. In following out their enquiries the commissioners visited the leading European countries where technical schools are in operation, and one member visited this country. Wherever their investigations extended, they obtained full information as to how the methods of technical instruction were conducted, and they made it their duty to ascertain the effects that extending good technical instruction had upon the industries of a nation. The first volume of the report prepared by this commission has just been presented to Parliament. The thorough way the subject has been investigated may be inferred from the size of the report, the first volume of which covers 600 pages, and will be followed by five more volumes. The report indicates that great activity prevails in the leading countries of continental Europe to give the rising generation of artisans proper training in the technicalities of the business for which they are intended; and in many instances trades are extensively taught in training schools, the science of the business being imparted along with the methods of skill and handicraft. Many men interested in labor matters think this continental system of acquiring trades in schools the best kind of industrial training, and the commissioners regret that the plan has made so little progress in Britain.

While we admit that much can be said in favor of industrial schools, we do not look upon them as the best place for training youths in the trade they expect to gain their livelihood from. The system is popular in certain European countries, merely because there is a burning desire to train artisans, and few workshops or factories are in existence where the rising generation can learn trades by apprenticeship. An introduction to the use of tools may advantageously be made in schools, but the proper way to obtain the practice which lays a wide foundation for industrial knowledge is in the workshop. Britain and America occupy a similar position in the methods of training workmen. They both have plenty of workshops where thousands of young men learn a business by working as helpers or apprentices. As the greater part of these future workmen go to the trade while young, they are imperfectly educated, and the problem their best friends are trying to solve is, how to instruct them in the technicalities of their calling. Britain says emphatically, this must be done by means of evening schools. Every facility of this kind is being provided for the young artisan, and he is given great encouragement to attend the classes and interest himself in the studies where the best of teachers help to smooth the road to knowledge. Encouraging and developing this form of education is properly regarded as a national affair, and government provides the teachers and the municipalities supply the schools, while numerous valuable prizes are given as a reward of special merit. Some of these prizes enable boys who exhibit special ability, to obtain appointments where the means of high scientific education are provided.

This is the line that ought to be followed in behalf of our rising artisans. We have established excellent technical schools in various States, but workmen receive no benefit from them. The great want of our country is evening technical schools, where young men may be encouraged to study the scientific principles underlying the business they are engaged working at during the day. Many young men are striving hard and laboring under adverse conditions to obtain knowledge that will aid them to a higher conception of their work, and our State governments look on with apathy, rarely offering a helping hand to those who are likely to be our most valuable citizens. If this country is going to maintain its place in the industrial struggle for existence, more encouragement must be given to imparting technical instruction to those who must bear the brunt of the battle.

Master Car Builders' Convention.

This convention met at Congress Hall, Saratoga, on the 10th of June, and lasted three days. President Garey presided, and in the opening address he advocated strongly the necessity for uniformity in car couplings, in the tread and gauge of wheels, in the form and height of car couplers, and he urged the association to throw the weight of their influence on the right side by adopting standards.

The report of Mr. Forney, the secretary, indicated that there had been a violent shaking of dry bones in the membership, and that many of those dead to the association's usefulness had been dropped, and their places filled by men interested in the work. The report showed that the association was financially in a healthy condition.

Several resolutions were offered and discussion carried on regarding the adoption of standards, and several changes were made in the sizes recommended by the association at previous meetings. The association passed a resolution to appoint a committee to urge on the managers and superior officers of railroad companies the importance of adopting standards as a means of effecting economy in repairs. By the decision of a letter ballot the members reported in favor of 4 feet $5\frac{3}{8}$ inches as the standard distance between the backs of the flanges of car wheels, and that measurement was declared the standard of the association. Several other propositions as to standards of wheels were rejected.

The committee appointed to investigate the subject of a standard truck for passenger and freight cars reported that they had examined the freight car trucks in general use in the United States and Canada, and did not find any which were sufficiently satisfactory to recommend as a standard. They recommend that wheels have a uniform spread of 5 feet; they think the box should have a free vertical motion (this condemns the diamond truck), and they recommend cast-steel for truck construction. Several strong reasons are advanced showing why that material should be adopted. In the drawings provided to show what the committee consider a good standard truck, they make the wheels 36 inches diameter. The axle has collarless journals 4x8½ inches. The Fletcher box lid is used, and good dust guards, made of leather, secured between two thin boards, indicate what they think best in that place. Two other forms of truck were shown, but the committee favored the first form, especially for heavy loads and fast trains. They did not think it was desirable to recommend any particular form of standard truck for passenger cars.

Mr. Forney read a valuable paper on the "Relation of Railroad Wheels and Rails to Each Other," particulars of which we will give in a future issue.

Reports were given on "Freight-Car Framing and Trussing," on "Brake-Shoes, Brake Beams, and the Interchangeable Parts of the Brake Arrangement of Cars," and several other subjects. The most important business done by the convention was agreeing to find means of reporting on a standard draw-head. They decided in favor of a coupler that would couple on a vertical plane, and selected seven or eight draw-heads that would be likely to fulfill the required conditions. They agreed to request railroad companies to subscribe funds to defray the expense of experiments to be made for the purpose of proving which coupling was best for a standard. The secretary of the association, Mr. M. N. Forney, was appointed judge of the couplings to be tested.

We receive every day or two a letter from some city inquiring where application should be made for a license as stationary engineer. A license for this purpose is required in comparatively few cities, but we cannot tell in what ones, because an ordinance is likely to be passed at any time. The necessary information can be obtained in any city by inquiring at police headquarters, to which place we refer several recent inquirers.

American Railway Master Mechanics' Convention.

The convention met at the Ocean Hotel, Long Branch, on June 17. Proceedings were opened by prayer, after which the Rev. Mr. Tompkins welcomed the association on behalf of the citizens of Long Branch. The roll call showed that forty-six members and three associate members were present.

In his opening address the president, Mr. Reuben Wells, of the Louisville and Nashville R. R., expressed his gratification at the increasing prosperity of the association as indicated by its increasing numbers, and in the growing interest of the members in the work the association is engaged upon. Since the association was instituted great improvements had been made on the locomotive engine, but they had to keep on with the work of still farther development, which in time would produce a machine more nearly perfect than had yet been reached. As the course of improvement goes on the engine will be made to do its work better, and the result of this will be that railroad companies will be able to transport passengers and freight with a smaller proportion of engines than is now found necessary. This means less capital invested in rolling stock, and will be a direct means of saving to the companies. Increased economy may be looked for in several lines of improvement. Combustion appliances will make better use of the fuel used. Convenient to many railroads are great masses of slack coal wasted at the mines and thus far found worthless as fuel. He anticipated that they would find means of making the locomotive utilize this coal. Many objections had been raised to the link motion as a valve gear for the locomotive, and numerous attempts had been made to supersede it, but thus far the efforts in this direction had not met with much success. The Joy valve gear had been tried on some engines, and he believed it was receiving some application in Europe, but he did not think it was any better than the link. He considered that by attending these meetings and interesting themselves in the work, the members would receive much benefit, and decided advantages would accrue to the roads they were connected with.

In his report, Secretary J. H. Setchel said: Never since the association was instituted did they meet under such favorable circumstances as at present. The association has increased 34 per cent. since last meeting, and the demand for annual reports and ready contributions to the printing fund indicated that a newly awakened interest was being manifested by many railroads in their proceedings. The report showed that the financial matters were in a very flourishing condition.

After the reading of the Secretary's report an hour was devoted to the discussion of questions raised by the members. Mr. Woodcock, of the Philadelphia and Reading Railroad, wanted to have the opinion of members as to how thin a tire could be run before it ought to be removed. A great many of the members spoke briefly on this subject, the general opinion being that a tire was safe till it was worn to a thickness of 1¼ inch. Some of them thought the safety in this respect depended to some extent upon the climate, and weight of the engine, and they would have these considered in permitting a tire to remain in service after it had got down to 1½ inch in thickness. Mr. Woodcock raised the question, because he had had a wheel break recently and some parties were disposed to attribute it to the tire being too thin, and it was then more than 1½ inch thick. The expressed opinion of the convention was that the thinness of the tire did not cause the wheel to break. During this discussion the point was made that steel tires were now wearing much better than they formerly did, owing to steel makers reaching greater uniformity in making tires.

Mr. Sprague, of the Porter Locomotive

Works, raised the question, Why should we not turn the wheel and tire slightly tapering, and press the tire on instead of shrinking it on? He explained that the former was their practice, and they found it gave very satisfactory results, and he considered the tension on the tire could be regulated better in that way than by shrinking. Many of the members took exception to proposing a change in their method of putting on tires. Most of them thought that accuracy could be attained by shrinking just as readily as by pressing the tires on. It was merely a question of leaving the tire an accurate degree smaller than the wheel. This could be done better by the average machinist than turning accurate taper fits.

Mr. Forney, Secretary of the Master Car Builders' Association, called the attention of the meeting to the standard distance between the flanges of wheels, established by the master car builders, and expressed the opinion that this association should adopt the same measurement. By a motion duly carried the meeting agreed to recognize 4 feet $5\frac{3}{8}$ inches as the proper distance between locomotive flanges, with the allowance of $\frac{1}{8}$ inch variation within and beyond that length for cast-iron wheels for trucks.

The Secretary next read a very long report on locomotive boilers, the salient points of which we will publish in a future issue. This closed Wednesday's meeting. Want of space obliges us to defer notes of later proceedings until our next issue.

About a hundred members were present and eleven new members were elected.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials, nor location will be published.

If our correspondent, S. A. D., who thinks he has discovered an error in the rule quoted from Trautwine, for finding the radius of a circular arc (Question 242), will carefully revise his figures we think he will find it is he who is in error.

(264) T. R. B., St. Louis, Mo., writes: Will you or some correspondent inform me if there is such a thing in print as a table of experiments on the heat-dissipating qualities of alloys used for bearings and rubbing surfaces; also, is there any means of finding how much heat a journal-bearing or rubbing surface of brass, or any other alloy, can dissipate per square inch of bearing surface, by calculation alone? *A.*—We do not think there is such a table as you mention in print, nor that you can make the calculation referred to from any available data.

(265) G., ——, asks: 1. Is there a machine with which a plain helical spring may be made of a length limited only by the length of the wire, and in such a way that as the wire passes through the machine the finished coil may be reeled up as fast as delivered? *A.*—Not that we are aware of. 2. In japanning small gray-iron castings, I find difficulty in getting the japan to adhere. I dip the castings, and though to all appearances well coated, after baking they show many places where there is no japan, looking as if the heat had caused the japan to peel off. What is the remedy, and what is the best work on japanning? *A.*—We do not know of a work treating specifically of japanning. There are two causes that suggest themselves for the japan coming off in spots, as stated. One is, that the articles are not properly cleaned; the other, that the oven is too hot.

(266) J. M., ——, writes: 1. I have two boilers, 4 ft. x 20 ft., with 12 flues 6″ diameter. The boilers have steam and mud drums. The grate bars are 18″ below shell; bridge wall 5″ from shell; grate surface 5 ft. x 4 ft. We use common Illinois lump coal Are the proportions given it proper? *A.*—We should place the grates 30″ below shell; bridge wall 6″ from shell; space below shell back of bridge wall 12″, tapering up to 8″ at back end. 2. The feed from heater is into mud drum; temperature of feed 204°. The boiler foams considerably. I think of changing feed to back end. Would I get better results by doing so? *A.*—We do not think it best to feed through mud drum. A good plan is to let the feed pipe enter at front end, continue inside the boiler just above the tubes to two feet of back end, turn to one side, then down, discharging in the open space near the bottom. 3. The heater is 5 ft. x 5 ft. and has four tubes $2\frac{1}{16}$″ diameter, the release pipe being 4″. I wish to run the exhaust from two pumps —pipes 1″ and $\frac{3}{4}$″ diameter—into heater. Would I get better results by running the exhaust from pumps into 4″ pipes than by running to heater? *A.*—We should, from our understanding of the matter, run the exhaust from pumps direct to heater. 4. Is a 4″ pipe sufficient to receive the steam from four $2\frac{1}{2}$″ pipes? *A.*—The area of a 4″ pipe is $12\frac{1}{6}$ inches; the combined area of four pipes $2\frac{1}{2}$ diameter is $19\frac{1}{2}$ inches. To be equal, the single pipe should be 5″ diameter. We cannot tell whether the 4″ pipe causes back pressure, because we do not know how much steam passes through it. If you heat the water to 204° with such a heater there is a probability of back pressure. 5. I send a sample of scale. What is it—is it dangerous—and what can be used to prevent its formation? *A.*—The samples are principally lime. You can keep it down somewhat by surface blowing, but cannot entirely prevent its formation. It is not especially dangerous. You might try the use of soda, but as your boilers are inclined to foam try in moderate quantity at first, say one pound, and if this does not increase the tendency to foam, increase the amount. 6. I am advised to try concentrated potash, also lye, for cleaning boilers. Would you recommend its use? *A.*—We should not recommend its use. 7. Is a plug valve better than a globe valve for blowing off? *A.*—A plug valve is generally preferred. In our opinion a gate valve is better than either. 8. How much fall should steam pipe have from boiler to engine; also, how much should exhaust pipe have from engine to heater? *A.*—We can see no advantage in giving slope of pipe from boiler towards engine. We should prefer to have the pipe lower at the boiler. If you can arrange the heater and the discharge from heater lower than the cylinder it is advisable to do so. Make the fall as is most convenient; one inch or more to the foot, if practicable. 9. What is the nominal horse power of a double cylinder engine 8″x10″, revolutions 150, steam pressure 50 lbs.? Please answer by an example. *A.*—The expression, "nominal horse power," has no meaning at this time. Such an engine, full stroke or lap valve, should be able to attain a mean effective pressure of 25 lbs., and $\frac{(50\text{x}250\text{x}35)}{33{,}000}\text{x}2=18+$ indicated horse power. 10. How much oil should I use per day for lubricating the cylinders of such an engine? *A.*—About one pint. 11. How much above the flues should the first, second, and third gauge-cocks be? *A.*—That will depend something upon how the flues are located. 3″, $5\frac{1}{2}$″, and $8\frac{1}{2}$″ will probably be satisfactory. 12. How much water should be carried above the flues for best results? *A.*—Carry water anywhere above first gauge cock that you find best. This can only be determined experimentally.

BUSINESS SPECIALS

Transient Advertisements, 50 cts. a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Mackenzie Cupolas and Blowers, 245 Broadway, N.Y.

SHAFTING STRAIGHTENERS—J. H. Wells, Tampa, Fla.

Springs—List free. T. F. Welch, 11 Hawkins st. Boston.

Presses & Dies, Ferracute Mach. Co., Bridgeton, N. J.

Steel Name Stamps, &c J. B. Roney, Lynn, Mass.

Interchangeable work a specialty. Send stamp for new Lathe Catalogue. E. O. Chase, Newark, N. J.

For first-class machine patterns and estimates, address John Valentine, 15 Alling st., Newark, N. J.

INVENTIONS perfected, designed, or patented. E. P. Robbins, M. E., Cincinnati, O.

42″ swing, 16′ bed, triple-geared engine lathe, good as new, for sale. Durkee & Keffer, Chicago.

"How to Keep Boilers Clean." A book mailed free, by James E. Hotchkiss, 86 John street, N. Y.

Fine tools and special machinery. Horace Thurston, 84 Clifford street, Providence, R. I.

Herbert W. T. Jenner, Mechanical Engineer and Solicitor of Patents, 632 F st., Washington, D. C.

Lyman's Gear Chart. How to lay out gear teeth. Price 50 cents. E. Lyman, C. E., New Haven, Conn.

Foot Power Machinery, for workshop use, sent on trial if desired. W. F. & John Barnes, Rockford, Ill.

The latest Improved Tack and Match Machinery is made by White Machine Co., Waterbury, Conn.

Pattern and Brand Letters. Vanderburgh, Wells & Co., corner Fulton and Dutch streets, New York.

Consulting Engineer and Mechanical expert, C. C. Hill, 84 Market street, Chicago, Ill.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

National and box chucks, foot and power lathes, and slide rests. Lodge, Barker & Co., Cincinnati, O.

DRAWINGS—Mechanical, electrical and Patent Office. All styles of artistic designing. Special facilities. Low rates. Wallace Metcalf, 140 Nassau St., N. Y.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

Improved Tack Machinery, made by The Willets Man'f'g Co., can be seen in operation at their works, 57 Clifford St., Providence, R. I.

The "Wax Process" Engravings shown in the AMERICAN MACHINIST each week are made by Struthers, Servoss & Co., 32 Frankfort Street, N. Y.

Difficult machines invented and built; coarse screws cut. V rotary files for fine milling, by mail 50 cts. Tower Machine Works, E. Brookfield, Mass.

Engine Lathes, Hand Lathes, and other fine tools. Assortment large: prices low. Frasse & Co., 62 Chatham St., N. Y.

The Complete Practical Machinist, $2 50; the Pattern Maker's Assistant, $2.50; Mechanical Drawing Self-taught, $4 00; books for practical machinists. Address, Joshua Rose, Box 3,306, New York City.

EXTRACTS FROM CHORDAL'S LETTERS, 400 pages, 12mo., handsomely bound in cloth. New and enlarged edition, with over 50 illustrations. Price $2. Published by John Wiley & Sons, 15 Astor place, New York.

MANUFACTURES.

Benjamin Rankin, Louisville, Ky., will erect an iron foundry.

R. W. & Thomas Francis, Calera, Ala., will erect a new foundry and machine shop.

The Columbus (O.) Machine Company are erecting an addition, 140x30 feet, three stories high.

The Ogden Plow Company has been organized, at Cedar Rapids, Ia., with a capital of $250,000.

The United States Cotton Company, Central Falls, R. I., are building a 248x90-foot addition, two stories high.

T. A. & L. F. Newman, 305 Fulton street, Brooklyn, N. Y., will erect a factory 75x57 feet, four stories high.

The Ansonia Clock Company, 13 Cliff street, New York, will erect a 25x100-foot factory addition, in Brooklyn.

Work has been begun on the buildings for a foundry and machine shop in Columbus, Texas, the first in that town.

The Tompkins Machinery and Implement Company, of Dallas, Texas, has been organized, with a capital of $250,000.

Mahlon Hamlin, Catawissa, Pa., recently called at our office. He is preparing to start a malleable iron foundry at that place.

Foster & Brown, machinists, Saccarappa, Me., have just shipped to Switzerland a machine for cutting telegraph paper.

Abilene, Lampasas, and Wichita Falls, Texas, are important centers of wool-producing industry. They each want woolen mills.

Workmen in the car shops of the Texas and Pacific Railroad, at Marshall, Texas, will be laid off one-half of each alternate week.

The Northwestern Malleable Iron Company, Milwaukee, Wis., are erecting an addition, 70x100 feet, two stories high. Business brisk.

The Murray Iron Works, of Burlington, Iowa, are building a 90-foot addition to their foundry, and are otherwise increasing their capacity.

Eight capitalists of Winston, N. C., are considering the feasibility of starting a mammoth saw-mill, on the river between Palatka and Crescent City.

The Hooker-Colville Steam Pump Company, of St. Louis, are proposing to increase their capital stock, from $48,000 to $150,000, and enlarge their operations.

Charles H. Reid, of Danbury, Conn., is building a new shop, 25 feet wide, 128 feet long, and three stories high, to be filled with new machinery as soon as completed.

The Penn Hardware Works, of Reading, Pa., have recently shipped a very large consignment of builders' hardware to England. They are now employing 300 hands.

It is said that the equipment of the new Scott Printing Press Works, now being erected at Plainfield, N. J., will cost $70,000. The very best tools and appliances are to be used.

The Willmans Mailer Company has recently been incorporated in Chicago, with $100,000 capital, to build newspaper-addressing machines. Corporators are Charles Willmans, Charles E. Post, and Sail Smith.

Smith, Gray & Co., Broadway and Fourth street, Brooklyn, N. Y, are erecting an 80x80-foot building, six stories high, for a manufactory of clothing. Engines have been ordered, also two new boilers, each 5x15½ feet.

J. W. Adams & Co., 35-41 Indiana street, Chicago, have issued a neat illustrated catalogue of the Vanderburgh improved automatic open-head, solid-die bolt and nut threading machines. The machines are described and prices given.

Mr. Lang, whom we noticed as recently calling upon us, says his name is Robert, not John, as we had it. Robert Lang, of the firm of John Lang & Sons, machine tool builders, Johnstone, Scotland, who recently called at our office, is now visiting American machine works.

The Putnam Manufacturing and Improvement Company, composed of parties from Rochester, N. Y., are about to start the first sash, blind, and door factory in Florida, at Palatka. They will put in an 18″x24″ engine made by McEwen Brothers, of Wellsville, N. Y.

The Hewes & Phillips Iron Works, Newark, N. J., have recently added largely to their boiler-making plant, in the way of power riveting machinery, power rolls, flanging furnaces, punches, shears, overhead traveling cranes, etc., with a view to use all modern labor-saving devices for making good work cheaply.

R. Woodman, 169 High street, Boston, Mass., has purchased the patents and is now manufacturing the Hudson speed indicator. This instrument, as made by him, is of convenient size for the pocket, and by slipping a spring cap over the triangular-pointed end, can be used for pointed centers with equal facility.

The Hamilton-Corliss engine, as built by the Hoovens, Owens & Rentschler Company, of Hamilton, O., is the subject of an illustrated pamphlet issued by that firm It is accompanied by a large lithographed plate giving two views of the engine. This engine has been built but a few months, but gives evidence of success.

The Richmond (Ind.) Machine Works, in process of building, consists of a machine shop, foundry, and blacksmith shop, and a wood-working department; it will be completed in about two months. It is owned by Joseph O. Dunham, who is the inventor of a new motor, the manufacture of which will be the specialty of his business.

"A New System of Weighing Machinery," is the title of a forty-six page pamphlet just issued by the Yale & Towne Manufacturing Company, Stamford, Conn. It gives illustrated descriptions of the Emery patent scales pressure gauges and testing machines. The pamphlet is well worthy of perusal by all those interested in accurate weighing and testing.

A new illustrated catalogue and price-list of machine tools, for iron and brass work, has been issued by Warner & Swasey, Cleveland, O. The cuts and printed descriptions give a correct idea of the design and construction of the tools, which consist of monitor lathes, vertical milling machines, screw machines, valve milling machines, hand lathes, and special fixtures.

We recently had a call from Joseph McGillivray, manager for W. T. Coleman & Co., 75 Beaver street, New York, who are introducing the Downie Eucalyptus boiler scale preventive and remover. This article is manufactured in San Francisco, and has been introduced on the Pacific coast with high success by Mr. McGillivray, as appears by looking over the testimonials printed in their circular.

The movement to establish a co-operative shoe factory by the members of the Knights of Labor, in the different assemblies in Pennsylvania, should the large manufacturers refuse to come to any agreement with their striking employes, is being vigorously pushed by the prominent leaders among the Knights. They say they can obtain all the capital required, and will be able to make as good shoes and cheaper than the manufacturers.

The Hendey & Meyer Engineering Company, of Denver, Col., is working full capacity, day and night. Besides an unusual proportion of the local work, it has several heavy jobs on hand to go long distances: A complete hoisting plant adapted to horse-power, and machinery for a sampling-works, to go to a large mine at Zacatecas, Mexico; a large automatic cut-off engine, crushers, rolls, and smaller machinery for the Colorado and Montana Smelting Company, Butte, Montana; and a large engine and boiler for Idaho.—*Engineering and Mining Journal.*

E. E. Garvin & Co, 131-141 Center street, New York, have issued a new edition of their illustrated catalogue and price-list of machinery and machinists' tools, made by them. Since the last previous catalogue was issued, they have not only enlarged their shop by the addition of a large floor, well stocked with tools, but have improved several of their machines, and have added some new ones. They also design and construct special machinery, to order, and do gear cutting and milling in all its branches.

The Westinghouse Machine Company, Pittsburgh, Pa., have issued four new descriptive illustrated catalogues of the Westinghouse engine. One is devoted to the engine as applied to general purposes of power, one to marine purposes, one to electric lighting, and one to ginning cotton. The cuts show how the engines are set up and used for each kind of work. Indicator diagrams and detail engravings are used. These engines are being sold more rapidly than ever before, and the works are run to their full capacity.

The works of the Chicago Scale Company are to be enlarged, by an addition 25x100 feet in size and four stories high, together with a smaller building for office purposes, 25 feet square and two stories high. The latter will be located between the old and the new factory buildings. Ground is to be broken at once. When completed, the new structures will increase the manufacturing and storage capacity of the company fully 100 per cent. An engine and boiler, with all necessary machinery for the equipment of the new works, have been purchased.—*Industrial World.*

The Osgood Dredge Company, 37 State street, Albany, N. Y., have issued a fully illustrated catalogue of their Osgood patent boom dredges, steam excavators and derrick cars, ditching machines, and hoisting machinery. As their machinery is of an advanced type, they have not hesitated to publish detail drawings of all the principal parts of the dredges, excavators, and hoists, together with full and plain descriptions both as to construction and operation. That they have been eminently successful with their machinery is shown by the testimonials appended to the catalogue.

The Philadelphia Textile Machinery Company is the name of a company recently organized in this city, for the manufacture of machinery for the preparation of stock for woolen mills. The company is located at Bruner's Mill, No. 426 North 23d street, but it will build a factory in a suitable location early in the fall. The company's affairs are under the direction of Messrs. J. K. Proctor and J. Henry Knowles. The company will undertake shafting work in all its branches, as well as millwrighting and general jobbing. It will soon be prepared to supply an improved line of dusting, washing, picking, burring, feeding and Garnett machinery to the trade.—*The Textile Record.*

Machinists' Supplies and Iron.

NEW YORK, June 19, 1884.

The supply business is in a condition of quietness, but cannot be characterized as dull.

In iron, we quote as follows: American pig—No. 1 X Foundry, $20 to $21; No. 2 X Foundry, $18.50 to $19; Grey Forge, $16.50 to $17, at furnace.

In Scotch pig prices have ruled—Shotts, $21.50 to $21.75, to arrive; Coltness, $21.50, to arrive, $22 at yard; Glengarnock, $20.50 to $21.50, at yard; Gartsherrie, 21.50 to $22.

Antimony is in fair demand in jobbing lots, prices being held fairly steady at 10½c. for Hallett's, and 11c. to 11¼c. for Cookson's.

Copper has been dull during the past week, with limited sales of Lake at 14c, and quotations for other brands, 13c. to 13¼c.

Spelter sells—Common domestic 4 50c. to 4.75c.; Refined, 8c. to 8¾c, with but few buyers.

Tin has advanced in price, on account of being held in a speculative way. Quotations for jobbing lots are, Banca 20¾c.; Straits and Malacca 19¾c.

✲WANTED✲

"Situation and Help" Advertisements, 30 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Mechanical draughtsman wants situation. References. Address H. W., 13 Gold street, New York.

Mechanical draughtsman, with practical experience, wants a situation. Address "Competent," BOX 3, AM. MACHINIST.

An experienced foreman on specialties in iron and brass is open to engagement. First-class references. Address, BOX 14, AMERICAN MACHINIST.

A thoroughly-educated mechanical engineer and draftsman, with long years' experience and good references, wants engagement. Address, AMERICAN MACHINIST, BOX 5.

Wanted—Position as superintendent or foreman. Sewing machine or gun work preferred. Twenty years' experience in charge of men. References. J. S. George, 375 Wyckoff street, Brooklyn, N. Y.

Wanted—A situation as tool-maker; have had eight years' experience as foreman in hardware manufacturing. Best of references given. Address "Mechanic," care of AM. MACHINIST.

Young man, machinist, would like permanent position. Has been foreman of small shop; at present foreman of planers. Address W. C. S., 527 Main street, Hartford, Conn.

Situation wanted, as foreman of a boiler shop. Have had 20 years' experience as foreman, and am conversant with marine stationary and locomotive work. Address George Marshall, care AMERICAN MACHINIST.

The advertiser, who has filled the highest situations in large Canadian wholesale firms, would like to hear of an opening in the United States where thorough business experience and training would be required. Has a good knowledge of machinery, etc., and would prefer a manufacturing or mechanical firm. Could travel, if need be, in United States or Europe. Highest references in Canada, or in England, and security if desired. Address, for fullest particulars, E., care of AM. MACHINIST.

For Sale—One No. 2 Brainard Universal Milling Machine, as good as new. Wells Brothers & Co., Greenfield, Mass.

Wanted to Purchase—A full or partial set of Patent Office Reports—bound volumes, with index—must be in fair condition. Perkins & Co., Grand Rapids, Mich.

Wanted—Second-hand screw-cutting engine lathe, to swing not less than 50 inches and take about 13 feet between centers. Must be of modern build and in first-class order. Address D. J. Murray Manufacturing Company, Wausau, Wis.

To Draughtsmen, Engineers, etc.—A complete set of detail working drawings of a horizontal steam engine. Cylinder 10"x18", of the most approved modern construction, with perfect balanced, double ported slide valve. For price and particulars, address J. K. Mackenzie, 1831 Carpenter st, Phil'a, Pa.

Machine Shop for Sale—One-half interest in small machine and repair shop; all new tools, and in thorough order; situated within 35 miles of Philadelphia, and good facilities for shipping by rail or water. Price, $1,900. For particulars, address "Specialties," care AM. MACHINIST.

FOR SALE, OR TO LET ON ROYALTY—A patent of merit, consisting of an ordinary caliper gauge combined with micrometer arrangement. The caliper is reliable, convenient for inside and outside measurement, from zero to any desired number of inches or fractions thereof. It can be manufactured cheaply; no special machinery required. Advertiser is a good machinist, has experience in manufacturing; would engage to work for the party, or would take partner with capital, to manufacture the caliper. Address

EDWARD SAUTER,
63 Governor Street,
Hartford, Conn.

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MANUFACTURERS OF
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FOR HARD COAL OR COKE.
INDISPENSABLE IN ALL SHOPS to keep **Bradley's Cushioned Hammers** and men fully employed, and reduce cost of production.
BRADLEY & CO., Syracuse, N. Y.
(ESTABLISHED 1832.)

Special Tools for all purposes for RAILWAY REPAIR SHOPS
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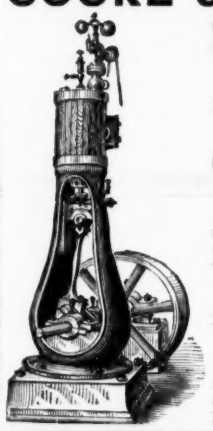
Please send for circular and state that you saw the advertisement in this paper.



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Cut Theoretically Correct.
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440 N. 12th St., Philadelphia, Pa.

"ECLIPSE" HAND PIPE-CUTTING MACHINE.
Simple, Powerful, Portable, Inexpensive. With it one man can easily cut 6-inch Pipe. Made in three sizes.
Address, for Prices, &c.,
PANCOAST & MAULE,
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Close Regulation, Best Economy, Simplicity of Valve Gear, and Low Prices, are features of
THE DEXTER
AUTOMATIC CUT-OFF ENGINE.
STANDARD SIZES ON HAND OR QUICK DELIVERY.
SEND FOR CATALOGUE A.
DEXTER ENGINE CO., 40 CORTLANDT STREET, NEW YORK.

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New and Complete Illustrated Catalogue,
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SEND FOR A COPY.
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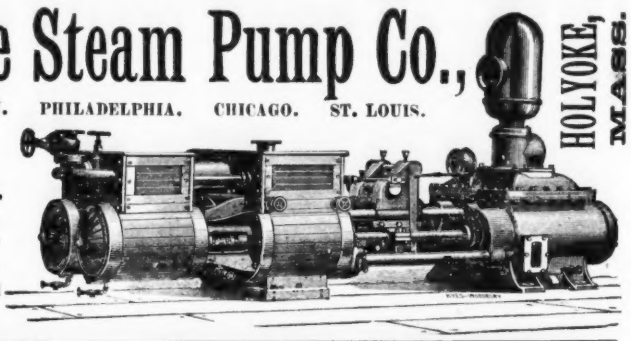

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The most economical, perfect, practical, simplest, cheapest, and elegantly finished Lubricators ever put on the market. One million sold within a couple of years. The **Barthel Solidified Oil or Lubricating Compound** is used with the **Lubricators** exclusively. Whoever has once tried this Lubricant will never again use oil or any other Lubricating compounds. Send for Illustrated Catalogue.

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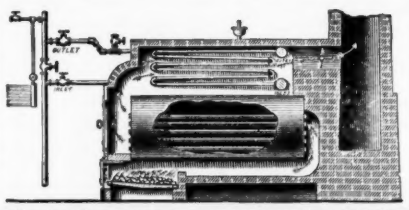

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DONALDSON HEATER COMPANY,
No. 18 Broadway, New York.

TABLES OF SPEEDS.
Tables of the principal speeds occurring in mechanical engineering, expressed in mètres in a second. By P. Keerayeff. Translated by Serglus Kern. Price, 20 cents. Descriptive catalogue of books, 100 pages, free.
E. & F. N. SPON, 35 Murray Street, N. Y.

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J.S.GRAHAM & CO.
TRADE MARK
WOOD WORKING MACHINERY
SEND FOR CATALOGUE. FACTORY ST. ROCHESTER, N.Y.

The STAR TOOL CO.,

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5 in. Cutting-off MACHINE.
Factory: Providence, R. I.
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THE NATIONAL
FEED WATER
HEATER
A brass coil heater supplying feed water at 210° to 212° Fahrenheit by use of exhaust steam.
Our prices are low and reasonable, and we aim to supply the *cheapest, best and most effective Heater in the market.* Fifteen sizes. No. 1, 8-horse Heater, $17. No. 10, 100-horse Heater, $150. Iron, Brass and Copper Coils and Bends made to order. Circulars and price lists sent on application.
National Pipe Bending Co.,
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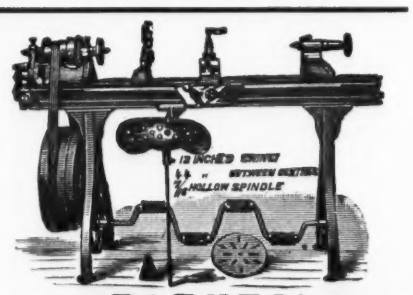

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Patent Foot and Steam Power Machinery. Complete outfits for Actual Work-shop Business. Lathes for Wood or Metal. Circular Saws, Formers, Mortisers, Tenoners, etc., etc. Machines on trial if desired. Descriptive Catalogue and Price List free.
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Improved 36 in. Sq. Planer,
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Wilmington, Del.
Planers, all Sizes
FROM
24 inch Square
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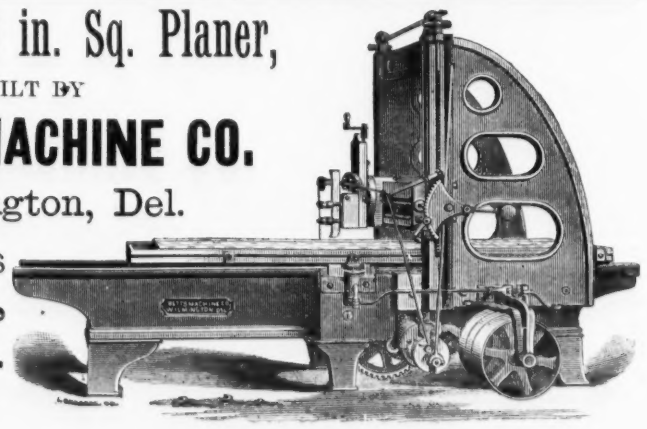
Any Length of Table.



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PITTSBURGH, April 10th, 1882.

C. A. MOORE, ESQ., PREST. CONSOLIDATED SAFETY VALVE CO., 111 Liberty Street, NEW YORK.

DEAR SIR:—In reply to your favor of the 7th inst., we would state that in October, 1874, we placed upon our boilers your 3-inch Nickel Seated Pop Safety Valves, which have always done their work satisfactorily, relieving the boilers instantaneously when the steam pressure reached the blowing off point, viz., 80 lbs. We have also furnished your valves to a number of our customers who have been well pleased therewith. The best evidence of which is the fact that after once using your valve they adopted them for their subsequent requirements. Yours truly, ATWOOD & McCAFFREY.

YOUNGSTOWN, O., April 14th, 1884.

C. A. MOORE, Esq., PREST. CONSOLIDATED SAFETY VALVE CO., 111 Liberty Street, NEW YORK.

DEAR SIR:—Replying to your letter of the 7th inst. It is now about twelve years since we commenced to use and recommend to others, "Nickel Seated Pop Safety Valve." From practical experience we have no hesitation in saying that it is the only Safety Valve in use, which can under all circumstances be relied upon. Yours truly, WILLIAM TOD & CO.

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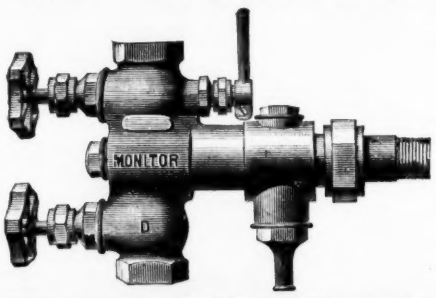

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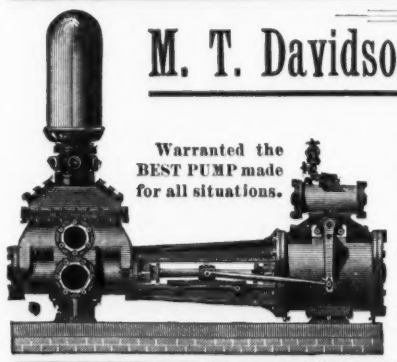

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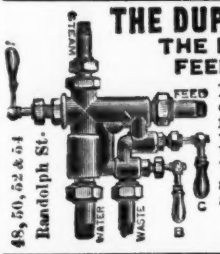

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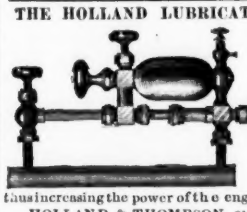

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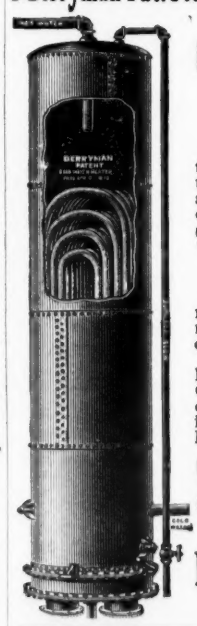

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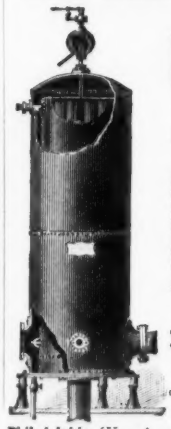

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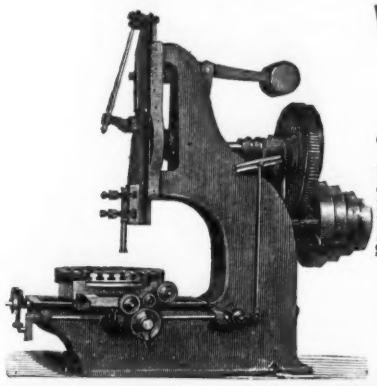

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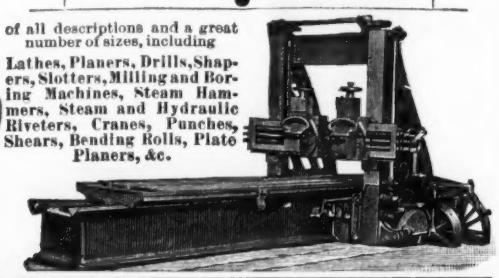

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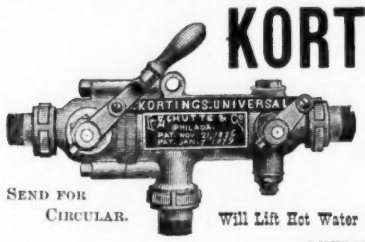

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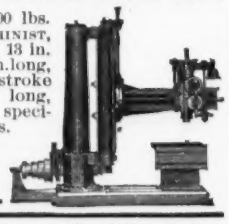

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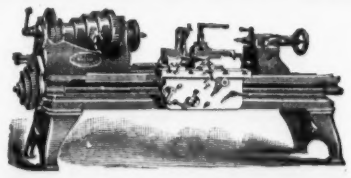

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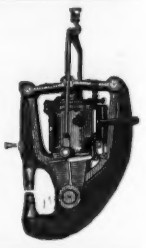

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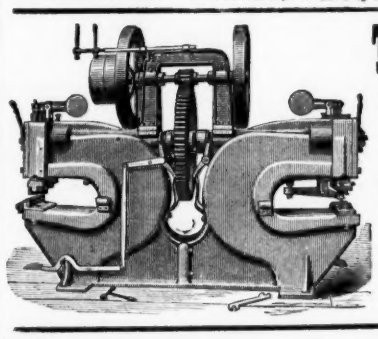

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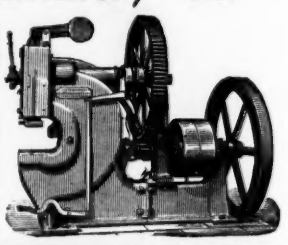

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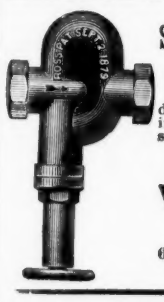

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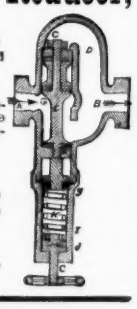

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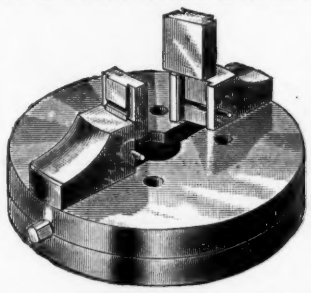

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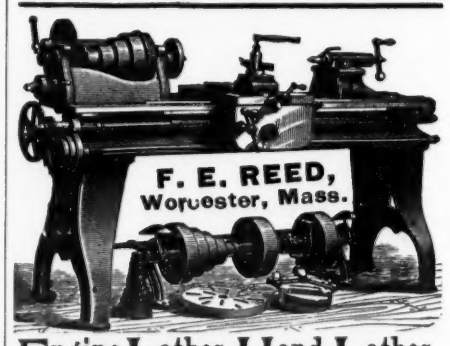

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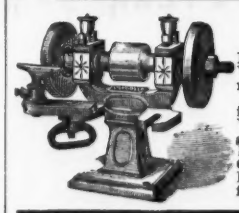

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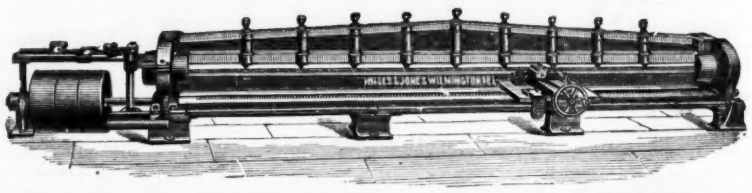

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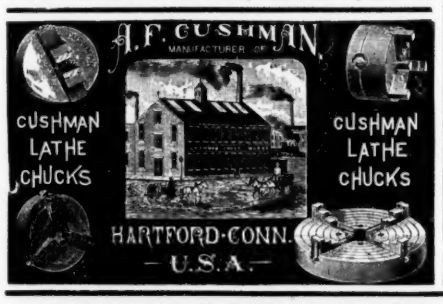

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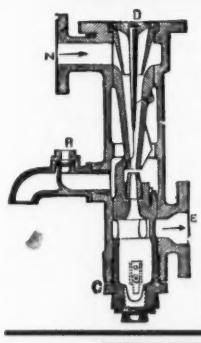

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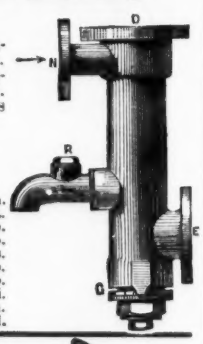

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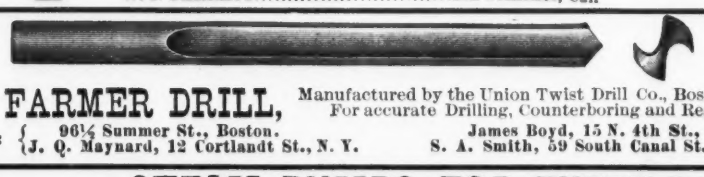

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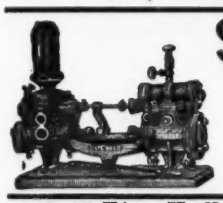

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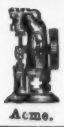

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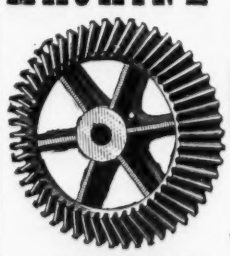

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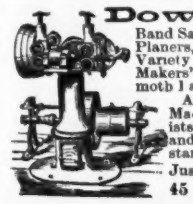

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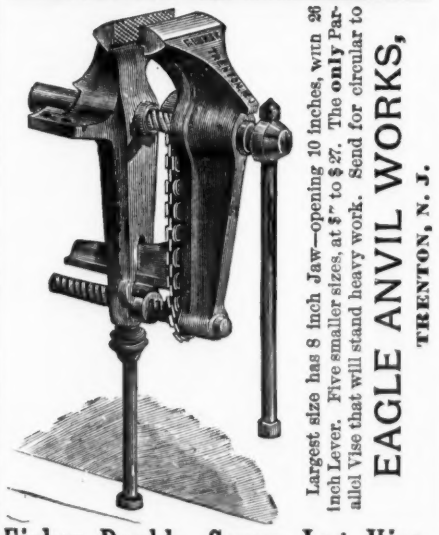

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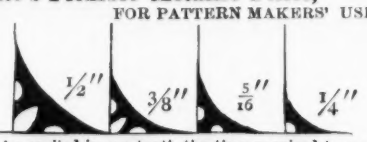

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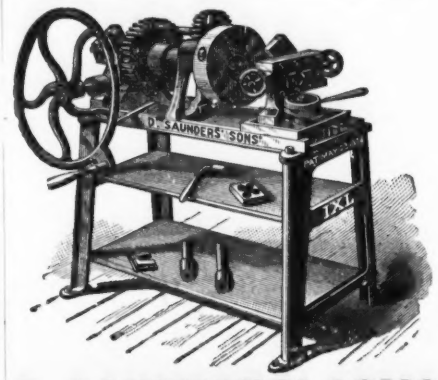

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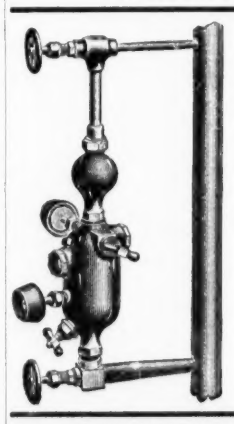

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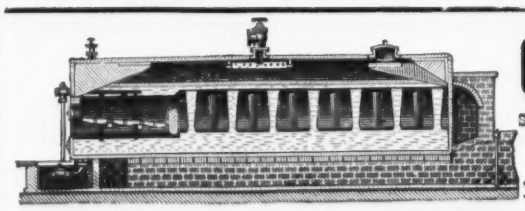

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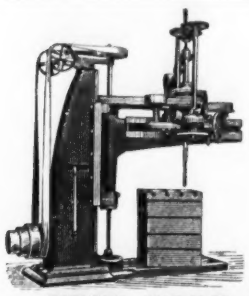

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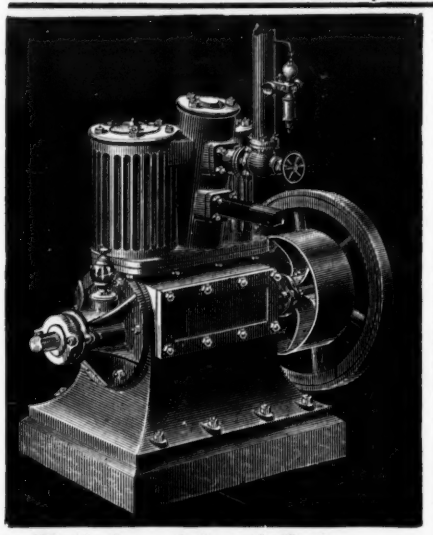

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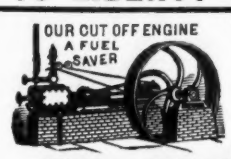

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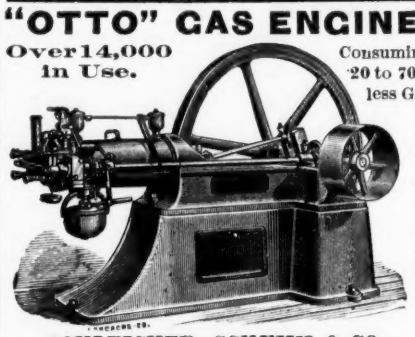

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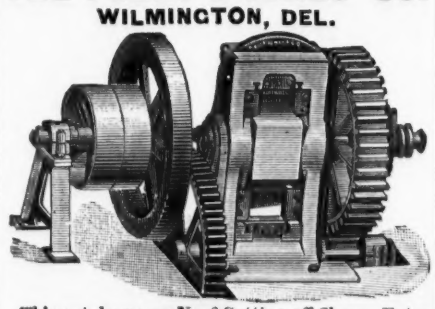

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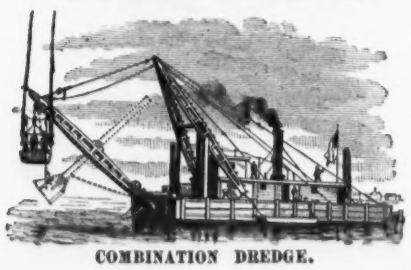

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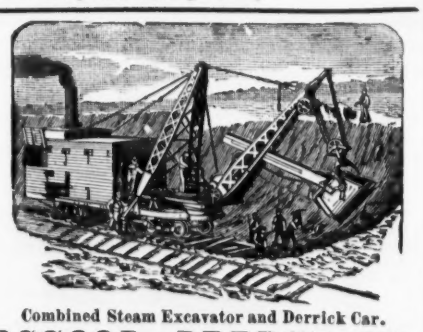

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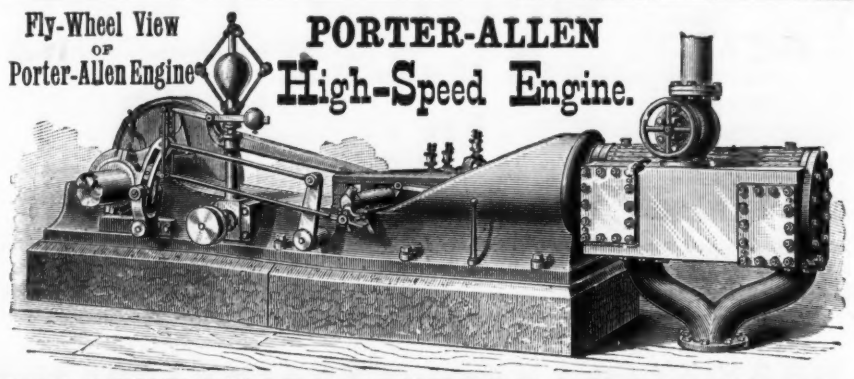

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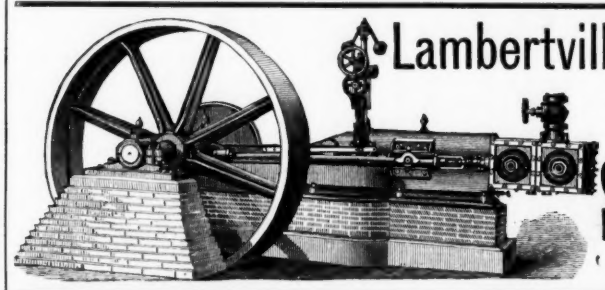

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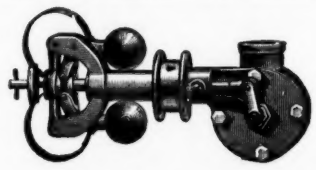

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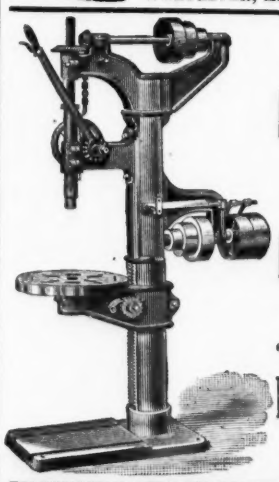

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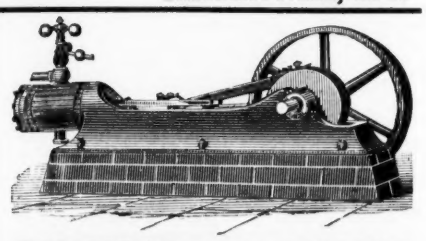

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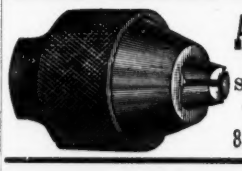

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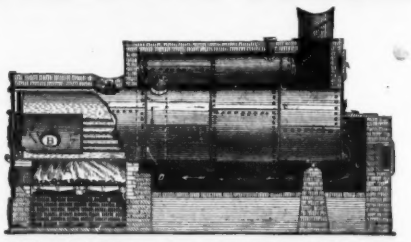

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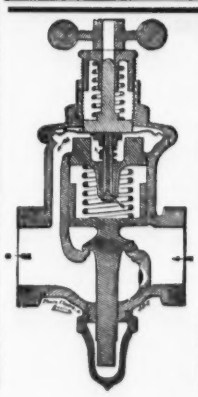

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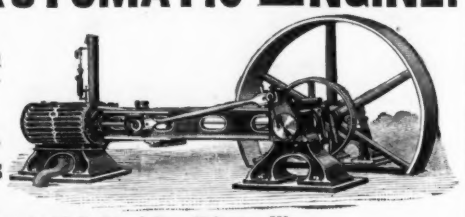

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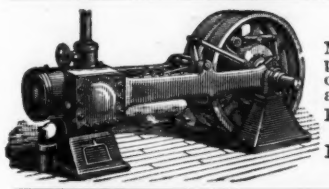

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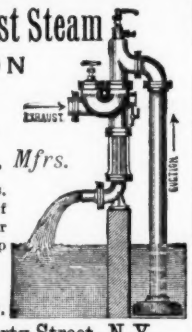

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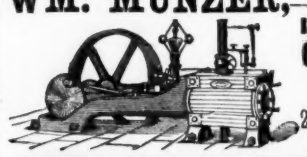

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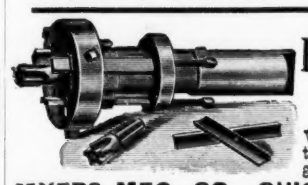

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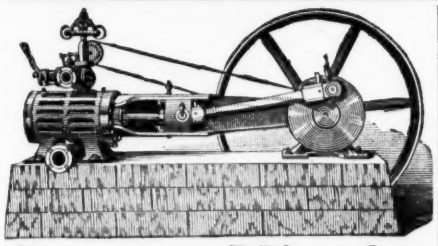

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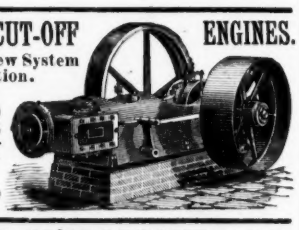

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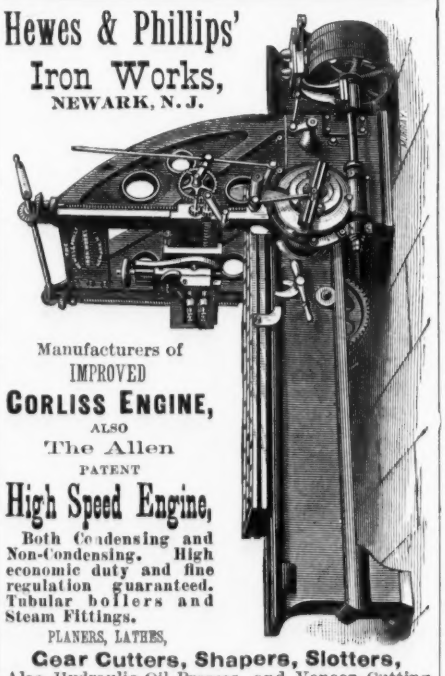

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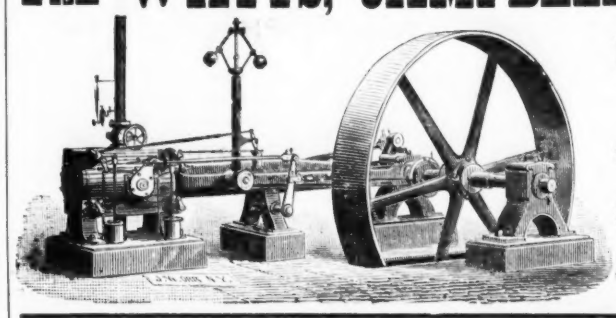

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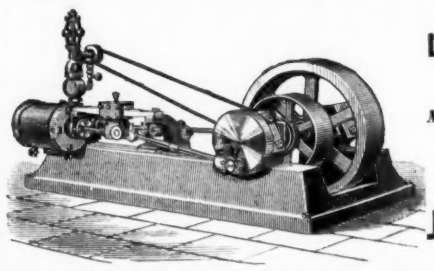

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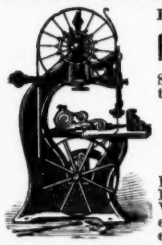

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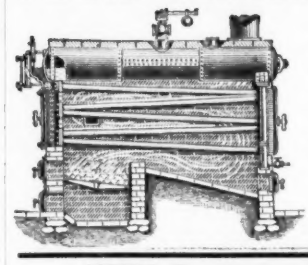

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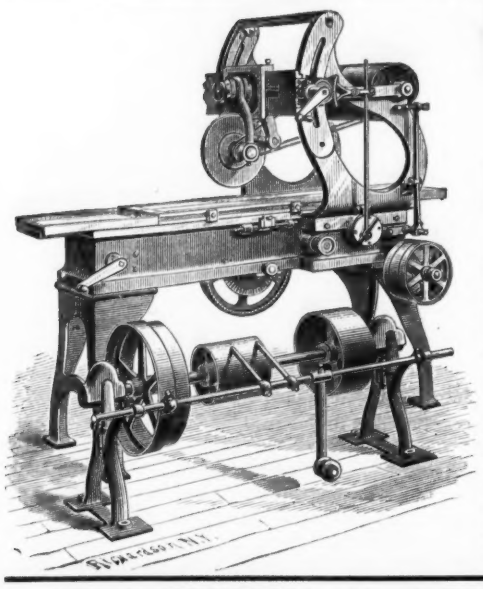

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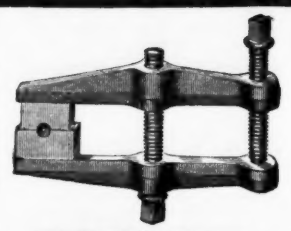

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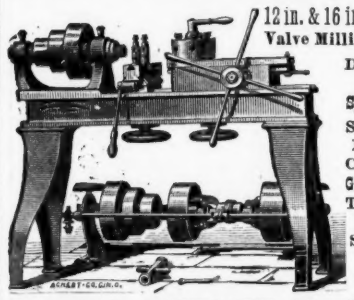

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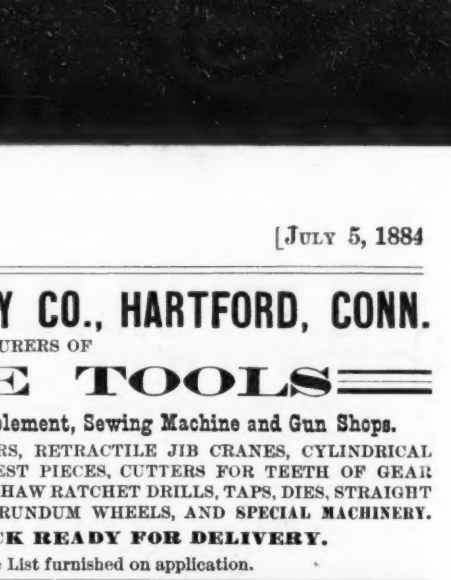

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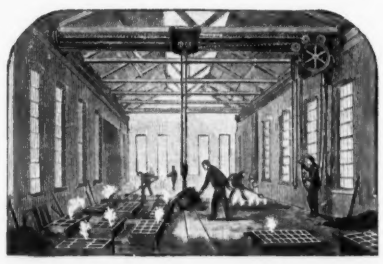

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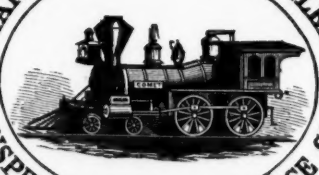

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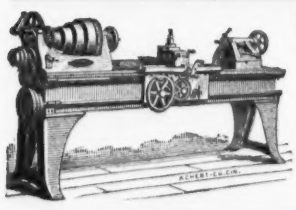

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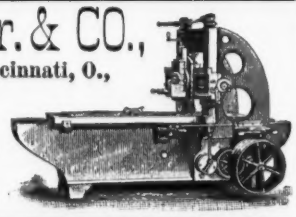

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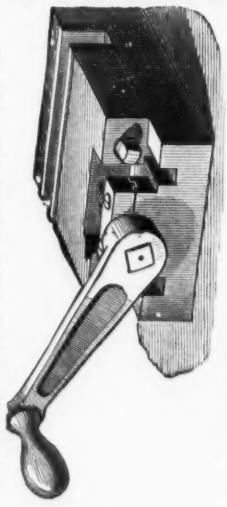

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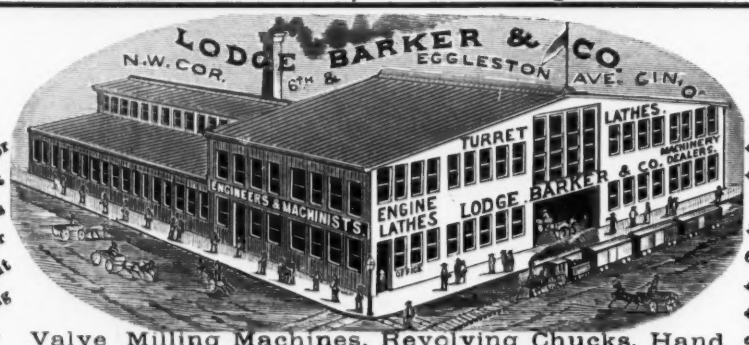

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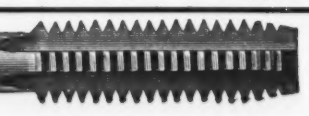

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